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THE WORLD OF SCIENCE

The World of Science knows no lines of race, nationality, wealth, creed, caste, or cut of garments. It is the purest democracy on earth, a brotherhood from which poverty bars no one—neither color of skin nor religious belief. Intelligent devotion to the pursuit of scientific truth, and competent effort, or support of effort, toward this end, automatically enrolls one in the great company of the "Fifth Estate". One may find in this real "league of nations" some of the most inspiring of human associations. In no department of human activity has there been more devoted service, more superb self-sacrifice, or greater contributions to human advancement. The "vow of poverty" is one of the prices one is often called upon to pay for the great privileges of being a worker in this field. On the other hand, here may be encountered some of life's greatest opportunities for service to humanity and certainly some of its greatest compensations. Happy are its devotees!

CHARLES FULLER BAKER,
Dean, College of Agriculture

HYMN TO LABOR

(Written expressly for the exercises celebrating the erection of the pueblo of Lipa, Batangas, into a villa, but received too late to be used on that occasion.)

MEN:

Now the east with light is reddening,
And to our fields and tasks we fare;
By the toil of man sustaining
Life and home and country there.
Though the earth be hard and stubborn,
And the sun unpityingly glow,
For our country and our homes
Love an easy way will show.

CHORUS:

For his country in peace,
For his country in war;
Let the Filipino work,
Let him live, let him die.

MATRONS:

Go then joyous to your labor,
While the wife awaits you here;
With the children learning from her
To hold truth and country dear.
When night brings you weary homeward
May peace and joy await you there;
But if fate unkindly frown,
She your stubborn task will share.

Chorus.

MAIDENS:

Hail to Labor! Blessed be it,
For it brings our country wealth;
May we ever hold it sacred,—
'Tis our country's life and health!
If the youth would win our favor
By his work his faith be shown;
Only he who toils and struggles
Will support and keep his own.

Chorus.

BOYS:

Show us then the way to labor,—
The road you ope to guide our feet;
So that when our country calls us,
We your task may then complete,
And the old men then will bless us,
Saying: "They are worthy of their sires:
For the dead are honored most
By sons whom true worth inspires."

Chorus.

JOSÉ RIZAL

Translation by Charles Derbyshire

A BRIEF SURVEY OF CONDITIONS AFFECTING AGRICULTURE IN THE BICOL REGION[1]

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WITH ONE TEXT FIGURE

For this survey only three provinces were covered: namely, Camarines Sur, Albay, and Sorsogon. This left Camarines Norte, the islands of Samar and Leyte and some smaller islands producing abaca, for survey in the future.

A considerable length of time was spent at Agdañgan and at Salvación in the Lagonoy District, commonly called Partido de Lagonoy; short visits were made to the municipality of Goa in the same district, and Iriga, all in the province of Camarines Sur. The towns of Ligao, Camalig, Daraga, and Legaspi, Albay, were also visited, and the barrio of Binagsacan in the municipality of Guinobatan, in which is located the Trial Abaca Station of the Bureau of Agriculture for the Bicol Region. A flying visit was made to Gubat, Barcelona, and Bulusan in Sorsogon and Libog and Tabaco in Albay.

OBJECTS OF THE SURVEY

The general object of this survey was to learn, from first-hand information, as much as possible about the character of the agricultural practice followed in the Bicol region.

The more specific objects were:

1. Investigation of farm management and varieties of abaca in the Bicol region, notably at Salvación, Camarines Sur; Guinobatan and Camalig, Albay. Special attention was given to the production of U. K. grades of abaca, that is, the lower grades of this fiber which are exported to England for the English and continental manufacturers. The region is famous for these grades of abaca.
2. Study of pasture conditions in Agdañgan, Camarines Sur.
3. Observations on weeds and on the cultivation of rice.
4. Collection of suckers of different varieties of bananas for the College of Agriculture.
5. Collection of plant material for the Herbarium and for the Department of Agronomy of the College of Agriculture.

ABACA

Varieties

There are many varieties of abaca under cultivation and growing semi-wild in the three provinces visited. The following varieties, under culture at the Salvación Hacienda and at Tigaon, Camarines Sur, were studied critically for taxonomic purposes: Samorong Pute, Samorong Pula, Samorong Itom, Bug-

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toğon Pute, Bugtoğon Itom, Bagacayon Itom, Isarog, and Ak-akon. The first two are regarded as the best all round varieties on the plantations, for they give the greatest weight of clean fiber, produce plenty of suckers, resist drought, and strip easily. Of all the varieties, Samorong Pula ranks first. From the standpoint of the consumer, Samorong Itom, the Bugtoğons, and Isarog are regarded as the next best, as they produce good fiber. But from the producer's viewpoint these varieties have objectionable features, as they are less resistant to drought, produce few suckers, and are difficult to strip. The Bagacayon and Ak-akon varieties are considered inferior and are classified under the general group *Quidit*, meaning stray plants growing on the farm. In Guinobatan, Albay, this type of abaca is known as *Amukid*.

The Amukiron variety in Albay is not a distinct variety. Any variety that has the features of the *Amukid* group may be called Amukiron. These varieties produce weaker fibers and low weight of fiber; for these reasons they are difficult to strip as the fiber breaks in the process. They are not resistant to drought.

Fibers of varieties Samorong Pula, Bugtoğon Itom, Samorong Pute, Samorong Itom, Ak-akon, Bagacayon Itom, Bagacayon Pula, and Bugtoğon Pute were brought to the College of Agriculture for the determination of their tensile strength. The results of these tests will determine the comparative tensile strengths of the fibers from the different varieties and may be the basis for corroboration, or otherwise, of the opinions of the landowners and tenants regarding the merits of the different varieties.

Varieties of abaca at Iriga, Camarines Sur, are identical to those of Partido de Lagonoy, except that, in some cases, they bear different names. For example, the Isarog of Partido de Lagonoy is known in Iriga by the name, Inisarog. In the case of the Samorong varieties, the planters often shorten the names by omitting the "Samorong" and calling them Pula, Pute or Itom. At Ligao, Albay, the same varieties are found as on Salvación Hacienda.

In Guinobatan, Albay, the most important varieties are the Pute, Pula and Itom. These are the Samorongs in every respect, only "Samorong" is dropped from the name. Besides these varieties, Mr. Domingo Baybay, of the Bureau of Agriculture Abaca Trial Station, mentioned two others—Pute Tumatagacan and Luyahon. These varieties could not be located in Guinobatan at the time of this visit. At the barrio of Binagsacan, Guinobatan, Albay, we found the Itom variety to be the most popular. Growing side by side with Itom were Pula and Pute varieties. At the Bureau of Agriculture Abaca Trial Station in the barrio of Binagsacan, young cultures of several Bicol varieties collected from Albay localities are under observation. It appears that a thorough survey of Sorsogon or Albay, the province in which the station is located, or of the Lagonoy district of Camarines Sur, has not been made. For purposes of comparison, leading varieties from Mindanao are under culture at the station. These trial cultures were too young for any study of varieties; but it is well to bear this particular work in mind for further work on the Bicol varieties of abaca.

In Camalig, Albay, the Pula, Pute, and Itom are common, but the best, most popular and most widely cultivated variety is the Samina. Stress was laid on this variety as being the best from all utilitarian standpoints. It is claimed to have originated in Mina, a place under the jurisdiction of Camalig, hence its name. Another variety, limited in distribution, is the Tipon-tipon, so called,

because of its habit of stooling. It is highly commended for its remarkable prolificacy, but objected to because its suckers crowd so as to render the tumbling of the stems quite difficult without slashing or injuring immature stems.

In Sorsogon, only one variety was studied, the Gasak. This variety is common at Bulusan on the Pacific coast, and is one of the most popular varieties in the locality. Other varieties occur in the province. In Sorsogon the so-called standard varieties are: Hilagonoy, Lausig, Pute, and Itom. Other varieties are: Binamban, Tabaconon, Bigahoon, Laguis, Urgarum, Baga, and Tinombaga. Some of the non-standard varieties of the region belong to the *Quidit* group. The Itom is an esteemed variety, but discriminated against because of its scanty suckering.

The Pacol and Canton, well known bastard varieties belonging to the genus *Musa*, were observed in a yard in Camalig and along the provincial road from Daraga to Sorsogon. A few scattered plants were found at Ligao, Albay. Bacacay, Albay, is reported as the center of Canton fiber production. These varieties received the name "bastard" because they are often stripped for fiber which is mixed with the true abaca fiber as adulteration.

The Canton resembles abaca (*Musa textilis*) in external features and in the habit of growth. It can be readily distinguished from true abaca by the pinkish coloration of the lower surface of the leaf, especially in the case of young leaves. There seems to be two forms of Canton: one with spotted stems and the other not. The Pacol variety is undoubtedly a *Musa errans*, a wild banana resembling in habit and other characters the Butuan variety. The origin of Canton variety is unknown. Whether it is a hybrid between an abaca and a wild banana, or an introduced variety remains to be determined. Critical studies of Canton will reveal its identity with *Musa cantoni*, a seeded banana. The Canton grows remarkably fast, is vigorous, suckers profusely, and is drought resistant. It can be stripped earlier than abaca and propagates more rapidly. It is a variety for the lazy as it needs practically no care and cultivation. It thrives in places and soils where abaca would not make a showing. It can be planted out in the open or in weedy fields. It has such vigorous growth that it crowds out other plants and kills, eventually, the most pernicious and persistent weeds, as cogon and talahib. Unlike abaca plantations, Canton continues producing healthy and large stalks without replanting, so is excellent to use for killing these plants. Like the Saba variety, the Canton spreads at a more rapid rate than either the abaca or the banana. It spreads around the old stalks and leaves the center of the hill open and clean. The stems are harvested before the appearance of the inflorescence and are allowed to remain on the ground for two to four days before stripping. It is claimed that this procedure renders stripping less difficult and the plant produces better fiber. If stripping is done soon after the stalks are cut, the fiber is brittle and fragile, hence difficult to strip.

The individual fiber of Canton as compared with the ordinary abaca fiber is distinctly tapering from the basal portion of the stem up to the top. To prevent detection when it is mixed with abaca fiber a good portion of the lower part and upper part of the stem is cut off, only the portion in the middle that contains fiber of more or less uniform size from the butt to the tip is stripped. Sometimes when put in hanks the false abaca fiber is inverted or more of the tip is cut off, so as to make it look uniform in size with the true abaca fiber. The difference

between the two, however, is slight and will hardly be noticed by an ordinary buyer. Quite often, the Canton fiber appears as clean and shiny white as true abaca.

The mixture of varieties in a plantation is very evident. In one plantation only, Salvación Hacienda, was a solid stand of one variety found, this was Pula. In most plantations there is an evident mixture of varieties, and also mixture of strains (forms) of one variety. Two strains of Samorong Pute were recognized in Salvación Hacienda, and designated by the names Samorong Pute No. 1 and Samorong Pute No. 2. With the exception of the heart, the two strains are identical. One strain has a yellowish green heart and the other a light maroon. Because of this mixture of varieties and strains the fiber produced is not uniform in strength and even in color.

As abaca producers claim to possess considerable knowledge about the comparative values of at least the different varieties grown on their farms, it is strange to find that there is no serious attempt at complete isolation of superior varieties from the inferior ones. There were many cases where a number of varieties, regardless of their kind, were planted side by side. The reason for this carelessness is attributed to several factors, the principal of which are:

1. The market does not discriminate against the fiber of inferior varieties. The basis of the government grading of fiber does not in any way recognize varietal characteristics. Under the present system no credit is given to the producer for the quality he produces. While there is a standard for tensile strength of fiber followed for different grades, so far as we could discover there is no standard for the tensile strength for different varieties.

2. The growers sell their product in the local market where the only basis for grading is the weight of the fiber. The buyer can make his own bargain with the producer or may reject the fiber. In other words the buyer dictates the price and is the final judge of the quality. The producer has no recognized standards to support his claim as to the quality of his product and its corresponding price.

3. Because of this arbitrary power of the buyer, the producer has no assurance that separation of varieties would pay him. Separating his varieties might increase weight of fiber but it would add to cost of production. And as the buyer is the dictator, the increase in weight might not offset the increase in production cost.

As to the introduction into the Bicol region of varieties from other abaca-producing regions of the Philippines, the planters at Lagonoy claim that they once introduced the Cavite varieties to see if they could produce the high priced Cavite abaca fiber used in making the popular "Tagal" braid. The result proved negative. While the quality of the fiber was quite equal to the Cavite fiber, it was discriminated against by the consumers abroad, as the greenish shade of the Cavite fiber was not retained by that produced at Lagonoy. Also the fiber obtained did not retain its silky white glossiness, but soon became dull and discolored.

Farm management

In the portion of the Bicol region surveyed the main agricultural industry is abaca, except in the southern part of Camarines Sur and adjoining part of Albay where the climate seemed to be too dry for this crop. The greatest atten-

tion was paid to this crop. The other agricultural industries of the region and their relation to the main industry were not overlooked in this survey. In importance, coconut and rice rank next to abaca. In the Lagonoy district the abaca plantations are mostly at the foot of Mount Isarog. The soil here is generally rich with plenty of humus, rather damp throughout the dry season. It is alluvial in some places. In the plantations visited in Albay and Sorsogon the soil is rather dry, except at places at the foot of the mountains, especially around Mount Mayon. The climate is very humid in Guinobatan, Albay, and quite so in Camalig and Tigaon. Typhoons are frequent and common in this region, especially in Albay and Sorsogon. Lagonoy district is the most fortunate in this respect.

Undoubtedly, abaca is the popular crop throughout the region. Even people in the dry districts where coconut and rice are predominant own abaca plantations in other districts. The planters whom we met claimed knowledge of its proper culture and said that it is easier to start and bring to maturity an abaca plantation than one planted to coconut. Generally, in the region, the crop is planted under the caiñgin method; that is, a forest or second growth forest land is cleared at a convenient time of the year. The resulting trash is burned and the area is further cleared of that which has not been reduced to ashes.

The suckers are planted immediately after the land is cleaned. In some places, planting is done even while the ground is in a weedy condition. The suckers are planted in small holes just wide and deep enough for the plants to be inserted and stand up solid. In Salvación Hacienda they utilize the stunted suckers locally known as *Taguiltil* from any hill on the plantation. These plants would not do for stripping. The planters claim that these stunted suckers are best for seed purposes; as they are quite mature plants they can better withstand adverse conditions.

Seeds from abaca fruits are used for propagation when suckers are not available and when the planters want to cover a large area at one time. Their principal objection to using seeds is that the plants take a longer time to mature and in many cases do not come true to the characters of the parent plant. Yet, when they start a new plantation they often utilize suckers from stray plants, known to have sprung from seeds scattered by birds. The origin of the Samina variety and others may be ascribed to this practice. Suckers that die are replaced.

Regular cultivation of the plantation is not practiced. When the farmer must depend for part of his livelihood upon his plantation while the abaca is maturing, he utilizes the spaces between rows for annual crops. In this case, some indirect cultivation is given the abaca. If this use is not necessary the plantation is started and left until it is in shape for stripping, which generally takes about three years. This information was obtained principally in Albay. If the practice is followed throughout the region it would indicate that the soil and climatic conditions therein are certainly highly adapted to abaca.

At the Salvación Hacienda in the Lagonoy district, the manager of the abaca plantation of about 800 hectares stated, that, according to his computations the average expenses of bringing a hectare of abaca to a stripping stage is about ₱150. In Sorsogon, the figure given by a big abaca producer was ₱120 a hectare, double what it was when he started as an abaca grower. This planter claims that he has built his abaca business from the very bottom up, beginning as a farm laborer, doing all phases of work in connection with the production of the fiber.

In the handling of the crop, there seemed to be little, if any, worry by the small producers, inasmuch as they do the work themselves with the aid of their families. The worry is with the big landowners who depend absolutely upon hired farm hands for all the operations of the plantations. Oftentimes, big plantation owners are hard up for farm labor for the care of their plantations or for extending them or for starting new ones. It is especially difficult to get reliable experienced laborers when the price of abaca fiber is high and the demand for farm hands to strip the abaca is great. Common-sense management and local experience with regard to labor is necessary to run a large plantation successfully.

At the Salvación Hacienda the following system of management is followed: The administration of the whole farm business is in the hands of the plantation owner, assisted by a cashier and a bookkeeper and a plantation superintendent who has the general supervision of all the farm operations, including the stripping of fiber. The superintendent who receives a monthly salary of ₱100, with board and lodging, is supposed to know the ins and outs of the business from the culture up to the marketing of the fiber. In addition to being superintendent he is the technical adviser of the manager. For this post, an old employee of the plantation, who has learned the business from start to finish right on the place and has proved highly efficient, particularly in handling tenant farmers, is usually selected. Under him are overseers, called *cabos*, receiving a salary of from ₱30 to ₱35 a month. They are in charge of a number of subdivisions, or lots called *lates*, consisting of two or three hectares each. Each lot is leased to a farmer who is supposed to do the work personally. Under his contract the lessee obligates himself to plant the crop, care for it and strip it according to instructions given by the overseer assigned him or by the superintendent. For wages, this tenant, or *aparcero*, gets fifty per cent of the fiber stripped from his lot; the use, free of charge, of a small patch of the ground within the lot, and his house and garden; and the produce of annual intercrops planted by him while the plantation was young. He also gets the produce of all the coconut trees found on his lot, except two nuts for every bearing tree every month which he has to deliver to the landowner. These coconut trees are said to have been purposely planted by the old owner, in order to attract *aparceros* and keep them on the farm. Both the manager and the superintendent stated that under this arrangement which had been followed by the former owner, many of the *aparceros* have stayed on the hacienda.

On this farm, cultivation is emphasized. The weeds are kept down by cutting them to the very root with the peculiar shaped Bicol bolo. This bolo is made with the point rounded and quite long, broadened and sharpened. This makes this end heavier than at the handle, so it is used like a scuffle hoe in cleaning off the weeds. With this bolo the plants are kept thoroughly clean of dry leaves and dry sheaths on the outside of the stem; a treatment which is claimed makes for a vigorous growth. All the waste from the cleaning and stripping the plant is scattered over the plantation as a mulch to keep the soil moist and conserve the fertility.

The harvesting of the crop is one of the most difficult problems of the producers. Harvesting time on well managed plantations is guided by the age of the stalks and not by the price of the abaca fiber. In some places, especially in small *lates*, harvesting time is governed by the market price of the abaca fiber

and also by the supply of hand labor. Plants are generally harvested as soon as the inflorescence has emerged. Oftentimes, plants are harvested just prior to the emergence of the flower stalk. When the price of abaca fiber is low, in small plantations, plants are allowed to stand in the field for some time; often being cut when the fruits are matured. This practice frequently results in partly deteriorated stalks.

In harvesting, with one stroke of the bolo with a slanting cut, the stem is severed so close to the ground that the lowest edge of the stump is even with the soil. These points in cutting are important and carefully followed. Horizontal or bruised cuts leave stumps that will hold water, which causes them to rot and invite disease. If a long stump is left by a horizontal cut, new suckers will develop near the ground instead of below as is the case with the close cut. As a rule, the suckers emerging from near the surface of the ground are slender and weak, while the ones coming from below the surface are stocky and vigorous.

Unless the producer has a sufficient number of men under his control to handle his crop by the *aparcería* system, he is likely to have difficulties in securing labor. The reason for this is, that when abaca brings a high price, strippers work on their own plantations or for the planter who offers them the most liberal share. And when low prices prevail they take other jobs that pay them better than abaca stripping. To maintain the productivity of the plantation, plants should be harvested when they come to maturity, as overmature plants deteriorate if left standing. As practiced in the Salvación Hacienda, plants are harvested when the fruits are all formed. While at Iriga, producers claimed to have found by actual trial that the proper stage at which the plant should be harvested is when the inflorescence starts to come out.

In connection with harvesting, there is a practice followed by some plantation owners in the Bicol region which should be condemned. This is the wholesale cutting of not only old plants but also the young ones that will stand stripping. Undoubtedly, this is one of the sources of the bad quality of fiber which gives rise to discrimination against our abaca by foreign importers. This wholesale cutting usually occurs when the plantation is let for harvesting to a contractor for a lump sum. Naturally, as there are no restrictions in the handling of the harvesting, the contractor cuts all he can, with no regard for the future of the plantation. This kind of harvesting is done when the price of fiber is high or when the owner is in sore need of money. In the municipality of Camalig, Albay, the writers saw a plantation which was being treated in this manner; the owner was ill, really on his death-bed, and the money was needed to meet the unusual demands. In addition to injuring the industry as a whole, this kind of stripping works against the interest of the plantation owner, as it is several years before the plants recover from this treatment. The practice is also one of the reasons for shortage of supply when the demand for abaca fiber is unusually great, and the owner of a plantation so treated loses the chance of the benefit of the high price.

In well managed plantations, the *cabos* are instructed by the owners not to harvest more stalks than the strippers can handle in a day. The stalks are generally cut late in the afternoon and the "tuxies" made early in the morning for the stripper. No "tuxies" are left unstripped overnight. In neglected *lates*,

however, this is not practiced, and often fibers are not dried until the next day. This results in poor quality of the fiber.

While we were in the Bicol region two types of fibers were being stripped; the *corriente*, and what is locally known as *lupis* or *tupus*. The first is produced by using a serrated knife and the second by using a smooth blade knife. The *lupis* is the best type, and in making it the stripper separates the "tuxies" into four classes. In the first class, the fiber coming from four to six outermost sheaths is entirely or partly discolored. In the second class, the fiber is from four to six sheaths, is almost white, within Class A. In the third class the fiber is from four to six sheaths, is white, within Class B. In the fourth class the fibers coming from the last sheaths, innermost, surrounding the heart, is soft white and fine, and within Class C. This fiber constitutes the A grade of the government. Tests of the tensile strength of the fibers from the different varieties of abaca of Lagonoy district have been undertaken and a separate report of this study will be made in the near future.

Stripping is done by either the native-made apparatus or by a machine. At Iriga, two types of machines were being used, the "Universal" with two knives and the "Agotan" with one knife.

The fiber stripped during the day is generally weighed in the afternoon by the *cabo* in charge of the *late*. The fiber is twisted in large hanks and stored temporarily in sheds near the *lates*. Later, they are taken to the town bodega.

In Goa, Camarines Sur, and in most of the other Bicol towns in the provinces, *taguiltil*, or stunted plants are used in making fiber which is woven into cloth for home use. This fiber is fine and white. A different sort of knife is used for stripping the fiber from *taguiltil*, as it is finer and more easily broken than from large plants.

In marketing, as stated under discussion of harvesting, the fiber is sold in the local market, except when the producer has direct connection with Manila exporters. In the market the buyer dictates the price and fixes the grade. In this, he is guided by the Manila quotations. Producers who know the ins and outs of the local abaca transactions said that the grade which the buyer fixes in purchasing is, as a rule, below the grade at which he sells the fiber on the Manila market. In addition to this gain, he gains from bargaining with the producer, and makes additional profit if the fiber is accorded a still higher grade by the government inspector. Our informants assured us that such deals are likely to occur at any time under the present system of handling the abaca fiber. In these transactions the producers, especially the small ones, are at a great disadvantage for the following reasons:

1. The producers have to sell their fiber as they produce it, as they have no adequate storing facilities for keeping it without deterioration.

2. No provision whatsoever exists for enforcing the Fiber Law so far as these local transactions are concerned. The producers do not know the grades of abaca as enforced by the government. They have neither knowledge nor power to adjust or fix the quality of their fiber or the corresponding price. They are at the mercy of the local buyers.

Some large producers of abaca have tried to escape from this disadvantageous position by eliminating the middlemen. One tried to market his product in London by shipping it at his own risk. The London merchants, as they had

agents in Manila, refused to deal directly with him. Consequently, the whole shipment rotted in the London port. Some others sent their product to Manila exporting houses. Here, through some irregularities, the bodega keeper replaced their shipment with bales of abaca of inferior quality. Discouraged, they concluded that they had no alternative than the local market with all its disadvantages. One big producer tried handling the Manila end of marketing his abaca himself. He greatly increased his profit on his crop, but he had to stay in Manila to act as his own agent. Consequently, his plantation suffered so much from lack of personal supervision, that his profit through his personal marketing was more than balanced by his loss through deterioration of plantation. So he gave it up and returned to the old custom of dealing with the middlemen on the local market in disposing of his fiber.

Of course with the big Manila concerns that have agencies in the abaca-growing provinces the situation is altogether different. Their agencies handle the business of buying the fiber and in some cases maintain abaca plantations in the province. Their own problem lies in getting from the producers the genuine product and getting government inspection on their export in accordance with the London contract regulation. In running their own plantations, they have advantages over the small producers and many large ones in having more capital and their own middlemen in their agencies. Furthermore, they own pressing establishments where most of their loose fiber is classified and pressed before shipping to Manila, where it is graded by government inspectors.

The individual producers, having no means of protecting their rights in the local market, keep their cost of production as low as possible. This results in a poor quality of fiber, but they can sell any quality, and all conditions considered, they claim they make as much as if they produced a good quality. They insist that so long as the distribution of profit is as at present, they will not change their cheap method of production to an expensive one.

The method of stripping used depends upon the grade of fiber called for. The stripping knives have either a serrated working edge of different degrees of fineness or a smooth edge; the serrated knife is used to strip the lower grades and the smooth one the higher grades, known locally as *lupis* or *tupus*. The strain in stripping is hardest, of course, with the smooth knife and lessens as the number of teeth per inch on the working edge of the knife decrease. So the knife has a good deal to do with the grade of fineness of the fiber. The position on the plant of the sheath from which the fiber is stripped also has something to do with the grade of fiber. The outer sheaths of the stems give an inferior fiber, the inner sheaths in the middle another grade, and the sheaths near the center or the heart still another grade, all things being equal. Again, in an individual sheath two grades may be produced; one, locally known as *saguilid*, is obtained from the region of the lateral edges and the other, known as *sagulod*, from the middle region. These fibers differ in tensile strength, fineness, and in color from the fibers from the sheaths on the outside that are more or less exposed. For the high grades, the sharp smooth knife is used and the adjustment of the strip-

ping outfit is kept very tight so as to completely remove the pulp and entirely separate the individual fibers. Mature stems are utilized for this grade as young ones would not stand the strain in stripping. This kind of stripping is strenuous and requires a skill that only experience gives. So great is the strain that the strippers cannot strip continuously. The work of stripping fiber of U. K. grades, or the lower grades, is not nearly so hard.

PASTURE CONDITIONS IN THE BICOL REGION

Although the main object of the survey was the study of the abaca conditions, while in Agdañgan, Camarines Sur, we did not lose sight of the opportunity to study pasture conditions. The data on the pasture studies will be presented in a separate report.

In general, however, it can be said that in the regions visited very few places could be assigned to pastures. While some grass land is available, little is suitable for cattle raising. There are two types of pastures in the region, one which we might call *lowland pastures*, suitable for carabaos, and the *upland pastures*, suitable for cattle. In the region at the base of Mount Isarog facing Naga, Pili, Mabatobato, are fine pasture grounds; as are the highlands of Agdañgan and the rolling grasslands between Sorsogon and Daraga. The best pasture grounds are those of Agdañgan, Camarines Sur.

The ranch owned by Mr. Mauro Prieto is situated southwest of the railroad running from Pili to Agdañgan, and almost north of Lake Baao. It comprises about 800 hectares. It is mixed lowland and upland pastures; the former supports 245 head of carabaos and the latter 135 head of cattle. Each herd is under a separate herder, and has a separate corral.

Another ranch which is larger, owned by the Unión Agricola y Pecuaria del Sur de Luzon is north of Mr. Prieto's ranch. It comprises about 2000 hectares. This ranch is devoted solely to cattle, supporting 800 head. A Filipino was in charge of the ranch under the supervision of a Spaniard who resides in Albay, and who visits the place but once a month and makes a count of the animals, noting their condition in a sort of registry book.

At the time of the visit, the height of the dry season, on both ranches the general condition of the animals, both carabaos and cattle, was good; they were fat and ready for the butcher's knife. Undoubtedly, the kinds of green vegetation of the pastures are responsible for this condition. The nearest local market for these ranches is Naga, the capital of Camarines Sur. Here, the animals are sold at good prices, quite comparable with Manila prices. There seemed on these ranches to be no definite line of improvement through systematic breeding or selection. Judging from the excellent pasture grass, such improvement would not take much outlay on feeds.

There are several smaller ranches in the Lagonoy district, extending as far as the region where conditions are ideal for abaca growing. The herds, however, are driven into the neighborhood of Agdañgan and Pili regions for the excellent grazing facilities obtaining there.

On the upland pastures of the ranches belonging to Mr. Prieto and the Unión Agricola y Pecuaria del Sur de Luzon, the most important species in the order of their dominance are:

Andropogon nitidus (Vahl) Kunth
Rottboellia ophiuroides Benth.
Cyperus sp.
Uraria lagopodioides (Linn.) Desv.
Andropogon micranthus Kunth
Ischœum aristatum Linn.
Apluda mutica Linn.
Andropogon aciculatus Retz.
Desmodium capitatum (Burm. f.) DC.
Desmodium triflorum (Linn.) DC.
Setaria geniculata (Lam.) Beauv.
Mimosa pudica Linn.
Imperata cylindrica (Linn.) Beauv.
Saccharum spontaneum Linn.
Andropogon halepensis (Linn.) Brot. var. *propinquus* (Kunth) Merr.
Leucœna glauca (Linn.) Benth.

On the lowland pastures the most important species in the order of their dominance are:

Eragrostis interrupta (R. Br.) Beauv.
Paspalum longifolium Roxb.
Panicum amplexicaule Rudge
Fuirena umbellata Rottb.
Scirpus grossus Linn. f.
Panicum repens Linn.
Mariscus dilutus (Vahl) Nees

OBSERVATIONS ON RICE

There is an immense area of low-lying level land in Camarines Sur on both sides of the railroad line running from Pamplona up to, and a little beyond, Agdañgan. The old rice paddies here are hardly marked by dikes, as is usual in other rice-growing regions in the Philippines. The paddies appear much larger than those in Laguna Province. At the time we were there the paddies were covered with weeds, and most of them lying idle because, we were told, of lack of farm hands and animals to work them. Judging from the topography of the region the low-lying land becomes submerged during the rainy season. A considerable area of rice paddies was found also on the way from Agdañgan, Camarines Sur, to Libog, Guinobatan, Camalig and Daraga, Albay, and beyond Legaspi. These, however, were interspersed with stretches where abaca or coconut is grown. Along the new provincial road running through Sorsogon, the surface is broken and in all valleys, fields, here and there, are devoted to rice culture. In the Lagonoy district, comparatively little rice land was seen. In general, in regions of Camarines Sur and Albay where the climate is too warm and dry and the land too low for abaca, fairly large areas suitable for rice are found.

The preparation of the land for rice planting in the Bicol region is on the whole rather primitive. The land is plowed and harrowed once previous to the transplanting of the rice seedlings or the broadcasting of the seeds. In some places the plow and harrow are not used at all in the rice paddies. In other

places, the paddies are plowed, but the rice harrow is seldom used. The plowed ground is rolled with a home-made wooden roller, called in the region *pagulong*, (figure 1). Attached to the roller are rows of flat iron teeth, about 4-5 cm. wide,

Fig. 1. Pagulong, used instead of harrow.

rounded at the tips. The rows are about 20-25 cm. apart and the teeth 8-12 cm. It is claimed that this roller plays a double rôle, that of a weeder and a harrow. As a weeder it cuts the weeds and turns them under the soil. As a harrow it is much less effective in combing out the weeds and stirring up the soil than the ordinary rice harrow. Before plowing, the land is usually flooded, the depth depending upon the supply of water, but generally the soil is well soaked and made ready for the plow or the *pagulong*. If the roller is used the land is treated twice. From planting till harvesting, the fields are not weeded at all.

Harvesting the crop is slow, as the harvesting knife used cuts only one or two panicles at a time. So far as observed the common rice sickle is not used in the region. As non-bearded varieties are grown all over the region there appears to be no reason why the sickle should not be used, thus saving time. There seems to have been no serious effort made to introduce among the Bicol rice farmers the implements and methods of rice cultivation and harvesting commonly used in other rice-growing provinces, so as to improve what appears to be undesirable practices in cultivating this staple.

Farmers in this region, who are engaged in rice culture as a business proposition, do not look upon their business as a profitable one. At Causip Hacienda at Agdañgan, the manager gave 30 cavans of unhulled rice as about the average yield per hectare for one yearly planting. Oftentimes the yield is less, owing to failure of the crop to mature on account of rains at the flowering period, to which cause his low yield is largely ascribed. His farming is run on a tenancy system of fifty-fifty shares; the tenant furnishing the man and animal labor and the landlord supplying the implements, the land, and the seeds. For the animal labor, the beginning tenant is given by the landlord on credit a carabao, which will eventually become his own at the local current price, to be paid for in annual installments out of his share of the crop.

The low yield on this hacienda is the average throughout the Bicol region, though it is sometimes as low as 10 cavans. There are places where 80 cavans to the hectare is not unusual. There is a tendency for farmers to raise other crops, as rice growing is not profitable. The crop is not as safe as abaca from plant diseases and pests.

From what was observed this low production of rice may be ascribed to the following causes: (*a*) In many places where water is plentiful for the paddies, the subsoil, especially in Lagonoy district and at Agdañgan, is sandy, hence it fails to conserve moisture. (*b*) A scarcity of work animals and shortage of human labor. Several attempts have been made to introduce laborers from other regions to work in the rice fields, but without success. They either quit before the termination of the contract or immediately after, and seek employment on abaca farms, which offer higher wages and steadier employment. (*c*) Too many weeds in the paddies. The paddies are not clean of weeds before planting, so there is a very keen competition between the rice plants and the weeds, and in most cases the rice succumbs. (*d*) The methods used in the preparation of the land are poor, and the implements, defective. The method of harvesting is rather slow. (*e*) There is loss through devastation by pests. At the time of the visit in Goa, a rice producer had lost nearly all his rice through the attacks of larvae, evidently of a moth, and locusts. (*f*) No effort whatsoever is made to use water judiciously. Flooding and draining the paddies are seldom regulated. (*g*) If the information received is correct, no selection of varieties or seeds is practiced.

NOTES ON SOME RICE WEEDS FOUND IN THE BICOL REGION

In conjunction with the rice observations we also noted the distribution of weeds in irrigated rice fields and the extent of damage done by them. The principal means used to eradicate weeds is the *pagulong*, which is not very effective.

Some farmers use the fields lying fallow for pastures, especially for carabaos. This is the only benefit derived from them. The weeds are so powerful in their attack and persistency that they keep the ground covered. Without question, when the fields are again put under cultivation this infestation of weeds reduces crop yields. Apparently, there is no careful planning about the control and eradication of weeds.

In the Laguna fields, whether of rice or other crops, the grass weeds predominate; in the Bicol region it is the Cyperaceous species. As study of weeds was not the principal object of the trip, and time was limited, we did not make critical studies of all the species of weeds found in the rice fields. Only the most dominant and the most troublesome and pernicious ones were noted.

Some of the most troublesome weeds found in the cultivated and fallow fields are:

Cyperus difformis Linn. This species is one of the most abundant species in fallow fields and seems to increase in abundance in cultivated fields. The plant produces an abundance of minute seeds. It has proved extremely difficult to eradicate. It is known in the vernacular as *bangkuan*.

Cyperus diffusus Vahl

Cyperus distans Linn. f. Common name, *langalang*.

Cyperus haspan Linn. Common name, *balabalangutan*.

Cyperus iria Linn. Common name, *sud-sud*.

Cyperus radiatus Vahl

Eichornia crassipes (Mart.) Solms. This species is very well distributed throughout the Bicol region,—especially abundant in low places, along ditches, etc. This is the common water hyacinth.

Eragrostis interrupta (R. Br.) Beauv. This is the most abundant and the most important species in lowland pastures; it is the worst weed in rice paddies.

Fimbrystillis annua (All.) R. & S.
Kyllinga monocephala Rottb.
Mariscus dilutus (Vahl) Nees, common name, *kadang-kadang*.
Marsilea crenata Presl. This is a water fern, found scattered in Agdañgan and Iriga, Camarines Sur, and also in Albay town and Legaspi.
Ottelia alismoides (Linn.) Pers. Common in waste rice lands. Common name, *lanting*.
Panicum crus-galli Linn. This weed is one of the most abundant in rice paddies in Laguna, but in the Bicol region its distribution is very limited; it occurs only here and there.
Paspalum longifolium Roxb. A troublesome weed in rice paddies.
Sagittaria sagittæfolia Linn. This is known to farmers by the name *tikog*. It is quite abundant in abandoned fields near Naga. It is recognized by the characteristic arrow-head leaves, which vary in size, depending upon the amount of water in which it lives. It is a perennial hydrophyte, producing a tuber at the base. The tubers are sometimes eaten by the farmers.
Scirpus articulatus Linn.
Scirpus grossus Linn. f. The most dominant species of the Cyperaceæ group. Common name, *agas*. Shows preference for ditches and neglected abandoned fields.
Typha capensis Rohrb. Very common in waste rice lands.

BANANAS

The most important varieties of bananas in the Bicol region in the order of their abundance are: Latundan, Saba, Boñgolan, Lacatan, and Tarnate. Of the whole Bicol region, Partido Lagonoy is the place richest in banana varieties. In Salvación Hacienda, alone, 22 varieties are cultivated in and around the abaca plantations, under the care of the tenants. The landlords have no share in the product. A large number of the varieties of bananas found in the Bicol region and not found in the College collection were brought to the College and are now growing in the plantation.

Varieties of bananas of the Bicol region: (Those marked (*x*) were brought to the College).

Bağaran, the common Lacatan.
Balungkawit.
Bangkayawan, a plantain resembling the Tundok.
*x*Batavia, cooking banana.
Binarnis, found in Guinobatan; an eating banana.
Bcğoran, the common Buñgolan.
*x*Calibo, a Saba type; cooking variety.
*x*Calimba pula, the common Tinumbaga variety of the Tagalog region; eating banana.
Calımba pute.
*x*Canara, one of the most promising varieties; also found in Luisiana, Laguna; eating banana.
*x*Inabaca, found in Guinobatan; eating variety.
*x*Inano, a dwarf variety found in Camalig; eating variety.
*x*Inaraña.
*x*Karatô, common in barrio Binagsacan, Guinobatan; eating banana.
*x*Lacnao, both eating and cooking variety.
Latundan.
Manáng.
*x*Morong Dato, known in Guinobatan, Albay, by the name Tudlong Dato.
Morong Princesa, has paler fruits than the Morong Dato.
*x*Pinipita, found in Guinobatan; resembles, closely, the Pelipia, both eating and cooking variety.
*x*Pinotiokan.
*x*Polotan.
*x*Putian, an eating banana.
Sába, the common Sabá.
Seneda, the common Morado; known in Camalig as Macopa.
*x*Sinarocsoc, known in Guinobatan as Sarotsôt, and in Tagalog provinces as Sarocsoc; eating banana.
*x*Tudok, a dwarf variety, resembles the Tampohin.
*x*Turangkôg, a Saba type with smaller fruit than the Sabá; cooking variety.

LIST OF PLANT MATERIAL AND SEEDS BROUGHT TO THE COLLEGE, EXCLUDING HERBARIUM SPECIMENS

Upon arrival at the College, with the exception of the herbarium specimens, all abaca specimens of fruits, hearts, etc., and the fibers from varieties of abaca, were given the Department of Agronomy (C. A.) accession numbers. The orchids, *Hydrangea* cuttings, and *Eugenia* seeds were turned over to the Division of Floriculture, Department of Agronomy. The seeds of two very important forage plants are being germinated by the senior writer. The grown plants will be later turned over to the Department of Animal Husbandry for propagation and multiplication.

The list of material

300 Pili nut seeds
Cuttings of *Hydrangea*
Orchids, three species
Seeds of edible *Eugenia* (Haguis); the sour macopa
Bananas (suckers)
Seeds of *Uraria* and *Andropogon nitidus*
Abaca
    Fibers
    Fruits, hearts, etc.
Herbarium specimens

ACKNOWLEDGMENTS

The writers are under great obligation to Dean C. F. Baker for his encouragement in this work. Acknowledgment is made for the help rendered and courtesies extended by Messrs. Antonio Prieto, Mariano Garchitorena, Buenaventura Erquiaga, Vela Hermanos, Domingo Baybay, Francisco Red, Luciano Santos, José Valenciano, Cleto Arnedo, and to the farmers in the Bicol region, and others who rendered assistance.

THE NUTRITIVE VALUE OF PHILIPPINE CEREALS: I. THE VITAMIN B CONTENT OF GLUTINOUS RICE, DEAD RICE, AND ADLAY[1]

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Of the Department of Chemistry

WITH ONE CHART

INTRODUCTION

Glutinous rice is used by Filipinos for making cakes, pastry, and the like. It is rarely cooked in the same way as the common rice.

Dead rice (*palay na patay*, Tag.) is obtained from palay (unhulled rice) that is stored in granaries before being thoroughly dried. Even when well polished it has a brownish color and a not wholly agreeable odor. In some sections of the country, dead rice finds favor among the laboring class because when boiled it expands more than the ordinary kind and is alleged to be very easily digested. In Batangas Province the preparation of dead rice is a common practice among the poorer class. The newly harvested palay is stored in a granary and left for about a year. As the palay is not well dried before storing, fermentation takes place, thus making what is known as dead rice. After some ten or twelve months, the palay is dried and hulled or milled like ordinary rice. When the drying facilities are poor, especially in the rainy season, dead rice is frequently produced accidentally.

Adlay as a food material is now being widely advocated. One of its champions is Mr. P. J. Wester (1923, 1925) for many years with the Bureau of Agriculture of the Philippine Islands.[2] As to the use of adlay for human food, more particularly as a substitute for wheat, Wester says: "We have found that hulled it cooks up like rice and can be so eaten; 'cracked,' it makes an excellent breakfast cereal; the meal mixed with equal parts of wheat flour, or two parts adlay meal to one part wheat flour, bakes into light, fragrant biscuits fully equal to graham biscuits or corn bread in palatability; biscuits made from adlay alone are of good flavor but are not so light as when the dough contains some wheat flour, hot cakes made from it are unexcelled. * * * Therefore considering that wheat flour is already an important import item which is annually increasing in value; the many and varied uses to which adlay can be put as a human food; that the grain can be grown with natural rainfall without the aid of irrigation; that the yield is about twice that of rice with the same amount of labor; that it is easier hulled than rice, that it is a more nourishing and a better balanced food than rice; and that the grain makes a capital poultry and other animal feed; it is believed that adlay merits serious attention as a grain crop in the Philippines." Whether it is really a more nourishing food than rice is yet to be proven.

[1] Experiment Station contribution No. 331.
[2] Resigned in 1925.

In connection with our studies on the nutritive value of Philippine cereals, we consider it advisable to report the following test for vitamin B in these three cereals: glutinous rice, dead rice, and adlay.

METHODS

The feeding test for the presence of vitamin B was used. A supposedly complete food mixture in which the grain under examination can be the only possible source of vitamin B was compounded. This diet was given to apparently healthy albino rats. When an appreciable increase in the weight of the rats is produced the sufficiency of the grain as a source of vitamin B is considered as established. When no increase in weight is noted, a known source of vitamin B is added to the ration. If, on the addition of this supplement, increase in the weight of the animals ensues, the grain in question is considered a poor source of vitamin B. During the period of the feeding test, water is given *ad libitum*.

MATERIALS

The feeds had the following composition:

1. Glutinous rice

Glutinous rice	66
Casein	18
Butterfat	9
Salt mixture	4
Lard	3
	100 per cent

2. Dead rice

Dead rice	66
Casein	18
Butterfat	9
Salt mixture	4
Lard	3
	100 per cent

3. Adlay

Adlay	66
Casein	18
Butterfat	9
Salt mixture	4
Lard	3
	100 per cent

The glutinous rice came from Cagayan Province.

The dead rice was obtained from Tayabas Province. It was taken from a supply that was being used as food by a family in Lucena.[3]

The adlay used was the edible variety. It was hulled and ground in this laboratory.

[3] This rice was secured through the courtesy of Mr. Alejo Jimenez, B.S.A., '23, formerly assistant in this laboratory.

The three cereals gave the following chemical analyses:

	MOISTURE	ETHER EXTRACT	ASH	PROTEIN	CRUDE FIBER	CARBOHYDRATES
Dead rice	13.65	0.60	0.91	9.34	0.38	75.14
Glutinous rice	13.27	0.33	0.30	5.66	0.20	80.24
Adlay	12.92	1.46	1.15	10.46	0.51	73.50

The salt mixture was prepared according to McCollum and Davis (1915). The other ingredients were the same as those used by the authors in a test reported in a former paper (1925).

Either dried camote leaves (Santos, 1922) or Harris' yeast vitamin prepared according to the method of Osborne and Wakeman (1919) was used as the control source of vitamin B; the former in one-gram and the latter in 0.2-gram doses.

RESULTS

The records of body weights and food intake are given in tables 1, 2, and 3. The body weights are also graphically shown in chart I.

From the tables and chart the following conclusions appear warranted:

1. Glutinous rice as the only source of carbohydrates can furnish enough vitamin B for the growth of rats.

2. Dead rice is a poor source of vitamin B. As the only source of carbohydrates, it does not furnish enough vitamin B for the growth of rats.

3. Adlay as the only source of carbohydrates can furnish enough vitamin B for the growth of rats.

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TABLE 1

Showing bi-weekly body weight and food intake of rats with glutinous rice as source of vitamin B

DATE	25 ♂		26 ♀		27 ♂	
	BODY WT.	DIET	BODY WT.	DIET	BODY WT.	DIET
1924	*grams*	*grams*	*grams*	*grams*	*grams*	*grams*
July 26	135		100		110	
August 9	164	144	128	132	146	137
August 23	169	117	128	127	146	115
September 6	177	110	155	115	171	110
September 20	179	131	147	109	175	161
October 4	176	133	140	107	175	105
October 18	200	141	156	121	200	163
November 1	202	134	159	133	205	156
November 15	224	138	181	123	227	128
November 29	220	139	171	174	220	153
December 13	229	158	177	133	225	167

TABLE 2

Showing bi-weekly body weight and food intake of rats with adlay as source of vitamin B

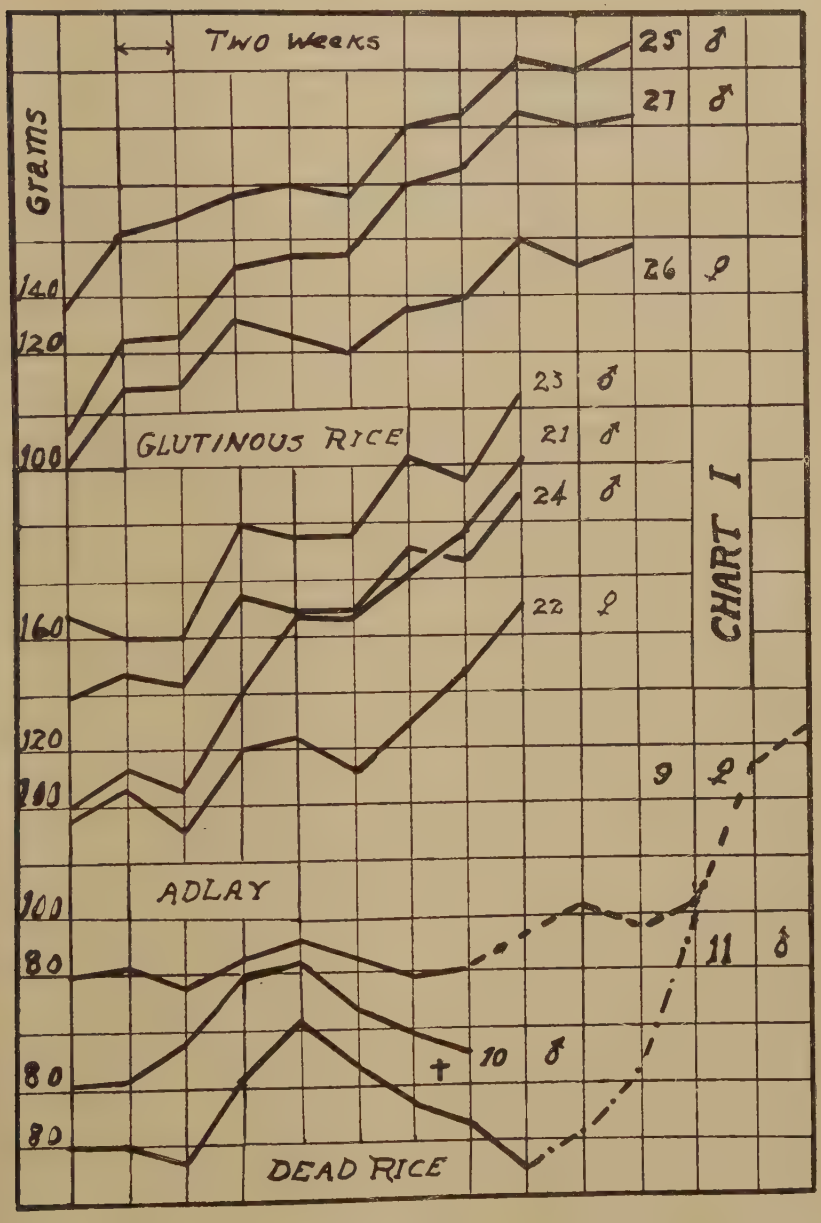
DATE	21 ♂		22 ♀		23 ♂		24 ♂	
	BODY WT.	DIET	BODY WT.	DIET	BODY WT.	DIET	BODY WT.	DIET
1924	*grams*	*grams*	*grams*	*grams*	*grams*	*grams*	*grams*	*grams*
July 26	100		95		167		139	
August 9	114	110	107	85	160	134	147	130
August 23	105	70	91	55	160	133	142	119
September 6	140	140	120	129	199	188	174	162
September 20	166	138	124	123	195	141	168	124
October 4	165	114	112	163	195	158	168	125
October 18	182	138	132	118	225	174	192	159
November 1	196	162	149	144	215	132	186	124
November 15	223	119	172	92	247	183	212	136

TABLE 3

Showing bi-weekly body weight and food intake of rats with dead rice as source of vitamin B

DATE	9 ♀		10 ♂		11 ♂	
	BODY WT.	DIET	BODY WT.	DIET	BODY WT.	DIET
1923	*grams*	*grams*	*grams*	*grams*	*grams*	*grams*
March 4	80		82		80	
March 18	83	55	83	45	80	65
April 1	76	36	95	51	74	60
April 15	87	44	120	76	104	90
April 29	92	57	125	75	124	82
May 13	86	52	109	64	109	73
May 27	79	73	99	60	95	68
June 10	81[a]	67	92	58	88	60
June 24	95	80	Died		70[a]	53
July 8	103	69			82	51
July 22	96	39			103	60
August 5	102	74			160	192
August 19	153	190				
September 2	165	140				

[a] Beginning of daily supplement.



Key to Chart

——— - ——— = growth on diet alone.
– – – – – – = growth on diet with camote leaves as supplement.
.–.–.–.–.–. = growth on diet with yeast as supplement.
\+ = died.

FENCES FOR FARM ANIMALS[1]

B. M. GONZALEZ AND J. P. ESGUERRA
Of the Department of Animal Husbandry

WITH EIGHT TEXT FIGURES

The construction of fences is recognized as an important factor in the management of a herd of animals. In the decade and over that we have been in charge of the College herds we have had an opportunity to try out many kinds and styles of fencing. In this article we summarize our knowledge gained from our experience in this connection with the hope that it may be of help to fellow stock keepers.

In the separation of animals for different reasons or purposes, as, to prevent injury to the younger ones when animals of different ages are kept, to control breeding operations, to segregate animals that are ready for fattening, training, castration, the market, etc., fences are well nigh indispensable. Of all uses, the most important, perhaps, is in isolating animals for purposes of prevention of disease, either from sick animals within one's herd, or from without. In spite of the frequency of epizoötics in Los Baños and in the barrios adjoining the College, the College herds have been comparatively free from disease, and this, we believe, is due largely to the efficient quarantine maintained whenever any danger lurks around. And the quarantine is made possible by our adequate fencing system. There is little doubt in the minds of persons cognizant of the situation that the rapid spread of epizoötics in the Philippines is in a large measure due to the little fencing used. After the harvest is over, it is a common practice throughout the Islands to give all the animals in a neighborhood the freedom of the fields, which thus become like the communal pastures of old. As a consequence, any sick animal easily becomes the focus of infection for all the others in the neighborhood.

The construction of fences is a costly undertaking, and it is but natural that stockmen and farmers in general should use them as little as possible. Where one can establish his herd so as to be away from other animals, as when the location is delimited by natural barriers as the sea, mountain ranges, and forests, fencing ceases to be an important problem. When possible a stockman in selecting a range will choose a site so situated and thus avoid or greatly lessen the expense of fencing.

It seems paradoxical, but nevertheless true, that the smaller the farm animal the more elaborate and the more costly the fencing required to shut it in or out. This is largely because a small animal can crawl through a small hole, hence the fence needs to be closely woven. Also, the smaller farm animals, as the chicken and the goat, are able to fly, or jump over or scale comparatively high fences.

[1] Experiment Station contribution No. 332. Received for publication October 15, 1925.

FENCING MATERIALS

The usual materials used for fencing in the Philippines are bamboo, wood, wire, and concrete.

Bamboo. This is the most common fencing material in the Philippines and in localities distant from sources of supply one of the most satisfactory. The usual way to make a bamboo fence is to set up round bamboo posts about one and a half to two meters apart. These posts are threaded together with heavy split pieces placed horizontally, which serve as the frame-work upon which the webbing is woven. This type of fencing is called *sala* in Tagalog (fig. 1). The material may be smooth or rough, depending upon the surroundings and the taste of the owner. This kind of a fence is best adapted for yards, where the

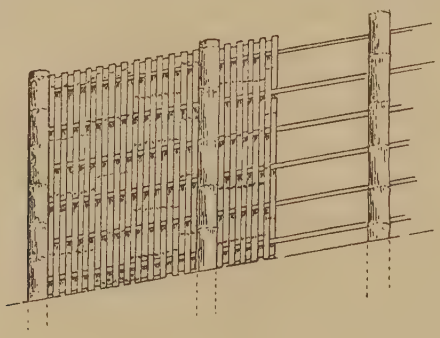


Fig. 1. *Sala* fence.

space to be enclosed is not large. At prices current in Los Baños 100 meters of *sala* fencing will cost approximately ₱172.00 and will take three men twenty days to construct. A *sala* fence looks neat when new and is effective in fencing in or out all farm animals from the chicken to the carabao. But it becomes unsightly rapidly on account of mildew, rots quickly, and falls an easy prey to *anay*, or termites. A bamboo fence will last about two years in Los Baños. This relatively short life is the greatest drawback to a bamboo fence. Where the climate is drier and where *anay* are not so abundant, it should last a little longer. To make the fence as durable as possible only well matured bamboo should be used.

Cost figures are given below for a fence 100 meters in length:

84 bamboo butts for posts	@	₱ 0.50—₱42.00
10 dozen bamboo	@	₱ 6.00—₱60.00
20 days' man labor to set posts, prepare material and weave fence, 1 man at ₱1.50, and 2 men at ₱ 1.00		₱ 70.00
Total		₱172.00

Where the material is available on one's premises and may be had for the cost of cutting, our figures are as follows:

Cutting and carting of bamboo	₱30.00
Construction	70.00
Total	₱100.00

These figures show that the initial cost of the *sala* fence is high. Because of this fact it is becoming rarer every year. The fence can be recommended only where bamboo and labor are abundant and cheap.

A modified bamboo fence, locally known as *bila* (fig. 2), is found more commonly around barrio houses than around stockyards. This fence is constructed out of wooden poles two meters in length sharpened on one end and set in the ground from ten to thirty centimeters apart, depending on the closeness desired

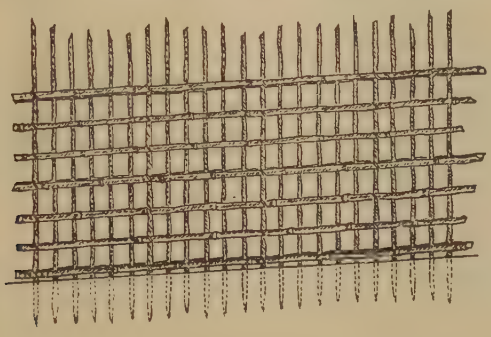


Fig. 2. *Bila* fence.

and the animals to be fenced in or out. Four to eight rows of split bamboo are tied horizontally to these poles or posts with vines or rattan, the middle and topmost lines being countered on the opposite side with a similar row so as to align and bind the poles. This fence may last from one to two years, depending on the materials used. Where the material is available on a farm, as it is with us, the cost for 100 meters is as follows, when the poles are set thirty centimeters apart:

6 days' man labor gathering poles	@	₱ 1.00—₱ 6.00
3 days' man and animal labor hauling poles	@	₱ 2.00—₱ 6.00
1 day's man labor gathering materials for tieing	@	₱ 1.00—₱ 1.00
4 days' man labor to set poles	@	₱ 1.00—₱ 4.00
2 dozen bamboo	@	₱ 6.00—₱12.00
4 days' man labor to tie horizontal pieces	@	₱ 1.00—₱ 4.00
Total		₱33.00

The *bila* fence is much cheaper than the *sala* and while its appearance is not as neat, it is as useful for all practical purposes.

Wood. An all-wood fence is most suitable for paddocks and catching corrals for cattle, carabaos, and horses. For this purpose posts and poles of ipil-ipil (*Leucauena glauca*) and madre cacao (*Gliricidia sepium*) have proven very satisfactory, locally. The posts should be set one and a half meter apart and the poles in four to six horizontal rows.

Where one has a wood lot from which to get the materials, as is usually the case when this kind of fence is contemplated, there is little cash outlay for the material as the expense is confined to the labor employed in cutting the wood and in making the fence.

To build 100 meters of this fence requires about 70 posts, 2 meters long, and 200 poles, 3 meters long.

4 days' man labor cutting and hauling of posts	@	₱ 1.00—₱ 4.00
5 days' man labor cutting and hauling of poles	@	₱ 1.00—₱ 5.00
4 days' animal labor for hauling the above	@	₱ 1.00—₱ 4.00
5 days' man labor digging and setting posts in holes	@	₱ 1.00—₱ 5.00
6 days' man labor nailing poles	@	₱ 1.00—₱ 6.00
10 kilos nails, 4"	@	₱ 0.25—₱ 2.50
Total		₱26.50

Fences made altogether from wooden posts and poles can not be recommended for extensive use for pastures as they deteriorate quickly and need frequent inspection and repair, requiring time and effort which the stockman generally needs for other purposes. In addition to this, the initial cost of this kind of fencing is relatively high.

We have never used the board fence as we figure it is too expensive for general use in the Philippines, on account of its short life owing to the termites and the weather.

Barbed wire. Barbed wire is best used in connection with wooden posts of ipil-ipil and madre cacao, bamboo butts, or with concrete posts. The posts should be cut two meters long, set 60 centimeters deep, and three meters apart. Three strands of barbed wire should be used. Less than three leaves so much space that calves can crawl under, and if the strands are set low some animals are able to jump over. The lowest strand should be about 35 centimeters above the ground, the highest 1.40 meters, and the middle strand a little closer to the lower strand than the upper. This kind of fence is suitable and satisfactory for cattle and carabaos, and can be used extensively on a range.

To construct 100 meters of fence with ipil-ipil or madre cacao posts will cost approximately:

2 days' man labor for cutting and carting 35 posts	@	₱ 1.00—₱ 2.00
2½ days' man labor for digging holes and setting posts	@	₱ 1.00—₱ 2.50
1 day's labor for stretching wire	@	₱ 1.00—₱ 1.00
1 day's animal labor for carting posts	@	₱ 1.00—₱ 1.00
1 kilo ¾" staples	@	₱ 0.30—₱ 0.30
¾ roll barbed wire (1 roll=402 m.)	@	₱ 7.00—₱ 5.25
Total		₱12.05

Such a fence should stand for about one and a half years with little or no repair. From that time on deterioration is rapid, due principally to *anay*, and continuous repair and replacement of posts is necessary.

Where economy is of paramount importance, or when one is short of wire, two strands of wire may be used. From the point of view of economy alone, the small saving in the cost of wire (in this case ₱1.75), hardly justifies the putting up of an unsatisfactory fence.

Even with the rapid deterioration, a barbed wire fence on wooden posts is the most practical and cheapest for range animals, as well as the quickest to build. However, as the replacement of posts is a continuous source of expense

and annoyance, one should endeavor to put in from year to year a few concrete posts, at least corner posts, especially at the boundaries. A barbed wire fence on concrete posts is permanent for all practical purposes.

Concrete posts. We have found posts 10 cm.×10 cm.×2.10 m. (4″×4″×7′) perfectly satisfactory and very reasonable as to cost. The mixture used is 1

Fig. 3. *a.* Reinforcing iron for concrete middle posts.

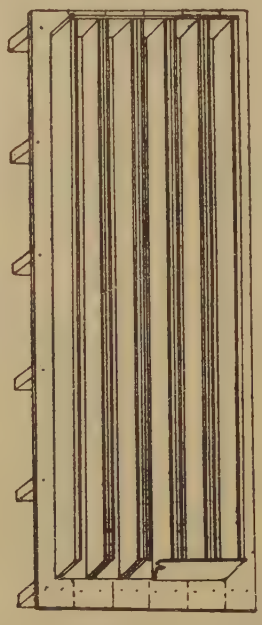


Fig. 3. *b.* Form for a battery of five concrete middle posts.

part cement, 4 parts sand, and 3 parts fine gravel.

A battery of ten posts can be made at one time by first making a suitable form. The lumber, one-inch stuff, for a form for 10 posts, will cost ₱14.10 and the labor to make it, ₱4.00.

Bill of materials for a form for a battery of ten concrete posts:

20 pcs. 1″×6″×8′	= 80 B. M.
10 pcs. 1″×4″×14′	= 47 B. M.
20 pcs. 1″×½″×14′	= 12 B. M.
1 pc. 1″×4″×4′	= 2 B. M.
Total	141 B. M.
Cost @ ₱0.10	= ₱14.10
Labor to construct forms, 2 days at ₱2.00	= ₱ 4.00
Total cost	₱18.10

This form can be used over and over again, in our estimation about twenty times. If well taken care of, it may last longer. The forms should be oiled before using to prevent the concrete from sticking to the lumber. For this purpose we use engine oil refuse. Posts coming from forms so treated need not be smoothed over.

The cost of making 100 concrete posts is approximately as follows:

4 barrels cement	@	₱ 7.00—₱28.00
1.2 cu. m. gravel	@	₱ 4.70—₱ 5.64
1.6 cu. m. sand	@	₱ 2.50—₱ 4.00
280 K ¼″ twisted reinforcing iron rods	@	₱ 0.19—₱53.20
40 K ¼″ round iron rods for cross piece stays	@	₱ 0.17—₱ 6.80
3 K G. I. smooth wire, 18 g. for tieing rods	@	₱ 0.35—₱ 1.05
10 days' man labor preparing reinforcing iron and fitting forms	@	₱ 1.50—₱15.00
15 days' man labor filling forms	@	₱ 1.00—₱15.00
Charge for use of form at ½ value		₱18.10—₱ 9.05
Total		₱137.74

Corner posts to match may be made in a similar way. A corner post is equivalent in material to approximately three plain posts.

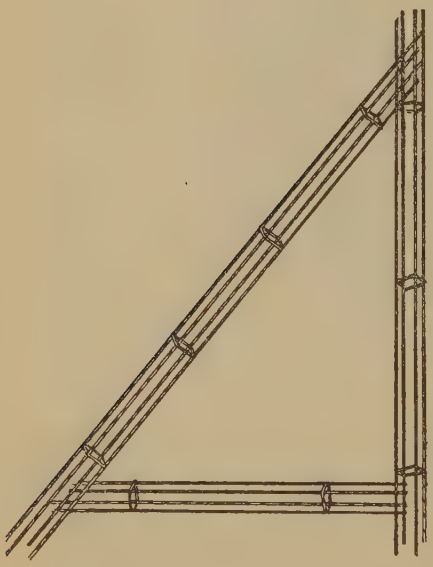


Fig. 4. *a*. Reinforcing iron for concrete corner posts.

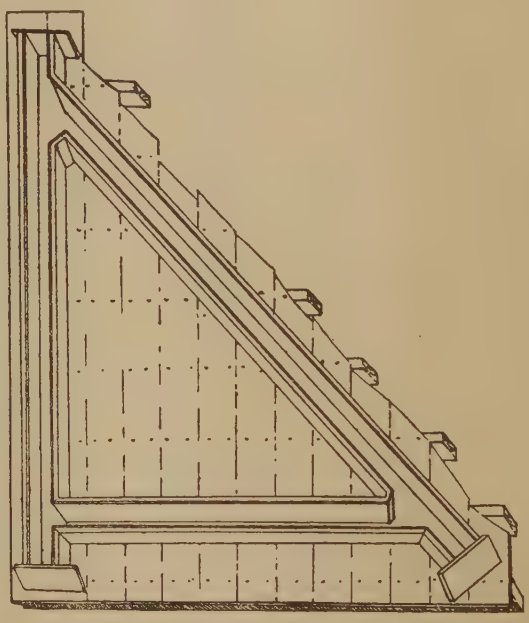


Fig. 4. *b*. Form for concrete corner post.

If one should desire to build a barbed wire fence with concrete posts, the cost for 100 meters will be as follows:

34 concrete posts 4″×4″×7′	@	₱ 1.40—₱47.60
¾ roll barbed wire	@	₱ 7.00—₱ 5.25
2½ days' man labor for digging holes and setting posts	@	₱ 1.00—₱ 2.50
1 day's man and animal labor for carting posts	@	₱ 2.00—₱ 2.00
1½ day's man labor stretching wire and tieing to posts	@	₱ 1.00—₱ 1.50
1½ kilos G. I. smooth wire, 12 g. for tieing	@	₱ 0.35—₱ 0.53
Total		₱59.38

Once a fence of this kind is constructed it will require very little attention during the life of the builder.

In the College, at the beginning, practically all our pasture fences were barbed wire on wooden posts. As these posts deteriorate and need replacing we set in as many concrete posts as possible. We make these posts whenever money and labor can be spared from more urgent work.

Woven wire. This material is particularly suitable for paddocks for horses, cattle, hogs, and goats. The height of the fence and the closeness of the weave depend upon the size and kind of animal that is to be kept in or out.

Wooden or concrete posts of the same kind and size as for barbed wire may be used. They should be set sixty centimeters deep and three meters apart.

As the cost of woven wire varies considerably, estimates will not hold uniformly. The figures given below are for 47″ wire which we have found suitable for most purposes. In case a different kind is used, the cost would be modified accordingly. The labor item in putting up the different kinds does not vary materially.

To lay out 100 meters of woven wire fencing on wooden posts costs, approximately:

2 days' man labor for cutting and carting posts	@	₱ 1.00—₱ 2.00
2½ days' man labor for digging holes and setting posts	@	₱ 1.00—₱ 2.50
1 day's man labor for stretching wire	@	₱ 1.00—₱ 1.00
1 day's animal labor for carting posts	@	₱ 1.00—₱ 1.00
1 kilo ¾″ staples	@	₱ 0.30—₱ 0.30
1 roll, 100 meters (20 rods) woven wire 47″ high	@	₱32.00—₱32.00
Total		₱38.80

Using concrete posts, the cost is as follows:

34 concrete posts 4″×4″×7′	@	₱ 1.40—₱47.60
1 roll woven wire 47″ (20 rods)	@	₱32.00—₱32.00
1½ K. G. I. smooth wire, 12 g., for tieing	@	₱ 0.35—₱ 0.53
5 days' man labor	@	₱ 1.00—₱ 5.00
1 day's animal labor	@	₱ 1.00—₱ 1.00
Total		₱86.13

Poultry wire. This wire is even more variable in height, size of mesh, and gage of wire than woven wire, hence, more variable in price. We have used wooden posts 4″×4″ set four meters apart in building poultry wire fences. As these posts rot at the bottom, it is great economy to use a post long enough that it may be lowered as it decays. The initial length of the post should be about fourteen feet. When it rots, the lower portion is sawed off and the post sunk, thus practically doubling the life of a post.

Another method we have used is to set a short concrete post such as we use for barbed and woven wire fences and clamp to it a seven foot 4″×4″ wooden post. In this way the wood is held out of the reach of *anay*, so lasts much longer. Whenever a piece rots it may be replaced readily by loosening the iron clamps. Apitong which we set in this fashion lasted over six years as against one and a half to two years when set in the ground.

Rough poles of ipil-ipil may also be used for this purpose, but they do not make a neat fence as the wire does not lie smooth. Poles thus used last approximately one and a half years in Los Baños.

For grown chickens a 2″ mesh wire is sufficient, but for chicks a closer weave, say 1 inch, is necessary to keep away their enemies, such as lizards, rats and mice,

etc. A strand of barbed wire should be stretched at the bottom of the fence line to keep the wire netting close to the ground, and a line of smooth wire on top will help keep the wire up and improve the appearance of the fence. In purchasing poultry netting it is well to remember that the finer the mesh the more expensive the fence. Also, the larger the gage of the wire the greater the cost.

The cost of laying 100 meters of poultry wire fence is approximately as follows:

Poultry wire fence: ipil-ipil poles for posts

2½ days' man labor for cutting and carting 26 posts	@	₱ 1.00—₱ 2.50
1 day's animal labor for carting posts	@	₱ 1.00—₱ 1.00
4½ rolls, 2″ mesh, 36″ wide poultry netting (45 m. to roll)	@	₱ 7.00—₱31.50
½ kilo poultry wire staples	@	₱ 0.50—₱ 0.25
¼ roll barbed wire	@	₱ 7.00—₱ 1.75
1½ kilo G. I. smooth wire, 12 g.	@	₱ 0.35—₱ 0.53
6 days' man labor	@	₱ 1.00—₱ 6.00
Total		₱43.53

Poultry wire fence: commercial lumber for posts

26 posts—apitong 4″×4″×14′=485.3 B.M.	@	₱ 0.10—₱48.53
4½ rolls, 2″ mesh, 36″ wide poultry netting (45 m. to roll)	@	₱ 7.00—₱31.50
½ kilo poultry wire staples	@	₱ 0.50—₱ 0.25
¼ roll barbed wire	@	₱ 7.00—₱ 1.75
1½ kilos G. I. smooth wire, 12 g.	@	₱ 0.35—₱ 0.53
5 days' man labor	@	₱ 1.00—₱ 5.00
Total		₱87.56

Poultry wire fence: 4″×4″×7′ lumber set on concrete posts

26 concrete posts	@	₱ 1.40—₱36.40
26 pcs. apitong 4″×4″×7′=242.7 B.M.	@	₱ 0.10—₱24.27
4½ rolls, 2″ mesh, 36″ wide poultry netting (45 m. to roll)	@	₱ 7.00—₱31.50
52 clamps	@	₱ 0.20—₱10.40
½ kilo staples	@	₱ 0.50—₱ 0.25
¼ roll barbed wire	@	₱ 7.00—₱ 1.75
1½ kilos G. I. smooth wire, 12 g.	@	₱ 0.35—₱ 0.53
7 days' man labor	@	₱ 1.00—₱ 7.00
Total		₱112.10

FENCING FOR DIFFERENT ANIMALS

Horses. For paddocks and pens a woven wire or a horizontal pole fence is best. A 47 inch woven wire fence with the bottom line set about 30 cm. above the ground makes a suitable and neat looking fence and is sufficiently high to keep a common native horse from jumping over. In the case of lively stallions we find it necessary to add one or two lines of horizontal poles above the wire used. Barbed wire should not be used for horses if it can be avoided. But on the range, where the pasture is roomy, barbed wire is not so dangerous and is the only practical material to use. Whenever and wherever horses are enclosed

in barbed wire fences, cuts may be expected more or less frequently, as the animals do not always know how to avoid the barbs.

A horizontal pole fence on wooden posts will also be found satisfactory for horses.

Cattle and carabaos. Barbed wire should be used for fences for these animals on the range, and woven wire about 47 inches high in paddocks. In catching corrals for range stock, and in calf pens, barbed wire is not to be recommended as the animals are likely to scratch themselves badly. A horizontal pole fence on stout posts set not more than one and a half meter apart, or a board fence will be found suitable for these inclosures. Woven wire may be used but is not so satisfactory as the poles as it has a tendency to give way when animals bunch up against it. This may be partially prevented by setting the posts closer together, about 1 to 1.5 meter apart.

Sheep and goats. Woven wire is recommended for the fencing in or out of these animals. A 47 inch fence is high enough. The closer woven bamboo fences are also suitable. Special care should be taken so that the braces for the corner posts are placed very close to the fence line, so they will not serve as gang boards to aid the goats in jumping over the fence.

Swine. Woven wire is the most suitable for fencing hogs in or out. Bamboo fences, if not expensive, are also satisfactory. For relatively tame hogs a partition fence about 30 to 36 inches (75 to 90 cm) high will answer, but the boundary fence should be about 42 to 47 inches high. Semi-wild native pigs will need a fence of this height.

Poultry. Either of the two bamboo fences described will be found suitable for poultry, if woven close enough. However, as stated in the first part of this paper, they are very expensive, when their durability is taken into account. The use of poultry wire netting will be found to be the most practical. For more or less temporary fencing the use of ipil-ipil posts is very satisfactory. For more permanent fencing, lumber set on concrete posts is very durable. We have used $4'' \times 4''$ third group lumber for posts, but in the repair of our fences we now use $2'' \times 4''$ lumber of better grade (yacal.)

The height of the fence should be at least six feet. This height is satisfactory for practically all imported breeds, including the Cantonese. For native chickens the fence should be eight or nine feet high, unless the yard is extra large, when six feet will be found high enough.

Two rows of poultry wire may be laid one above the other to make the desired height. The wire should be of two inch mesh. When chicks are kept and they are bothered by rats, then smaller mesh wire, 1 or 1½ inches, may be used for the lower row.

GENERAL HINTS ON BUILDING FENCES

The line of the fence should first be determined, and with the help of long stakes or a string a line as straight as possible should be established. Any vegetation in the way should be cleared off, and if woven wire or poultry wire fencing is to be used all unevenness on the ground surface should be leveled.

Having established the line, stakes should be driven at stated intervals to mark where the holes will be dug. The holes should be dug about 20 cm. in diameter and 60 cm. deep. A post digger, such as is illustrated in figure 5, will be found to be a most convenient tool. It costs about ₱4.00. Not having this tool, a crowbar may be used, but work with it will be rather slow.

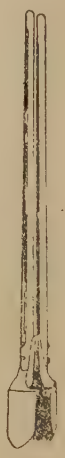


Fig. 5. Post digger.

The next step is to set the posts in the holes and align them. If the surface of the ground is uneven it will be necessary to dig deeper or partly fill in the holes so as to have the top line of the fence level or at least slope evenly. The soil should be filled in the holes gradually, tamping it more or less continuously with a pole so as to pack the earth solid about the post.

The corner posts are set in the same manner but with greater care. A system of bracing wooden corner posts is illustrated in figure 6.

In nailing the wire, one end should be first fastened firmly by winding it around an end post and tieing or nailing it. The barbed wire is caught at a convenient length with the fork of the claw of the hammer, then setting the head end of the hammer on a post and pulling on the handle a leverage is attained which is strong enough

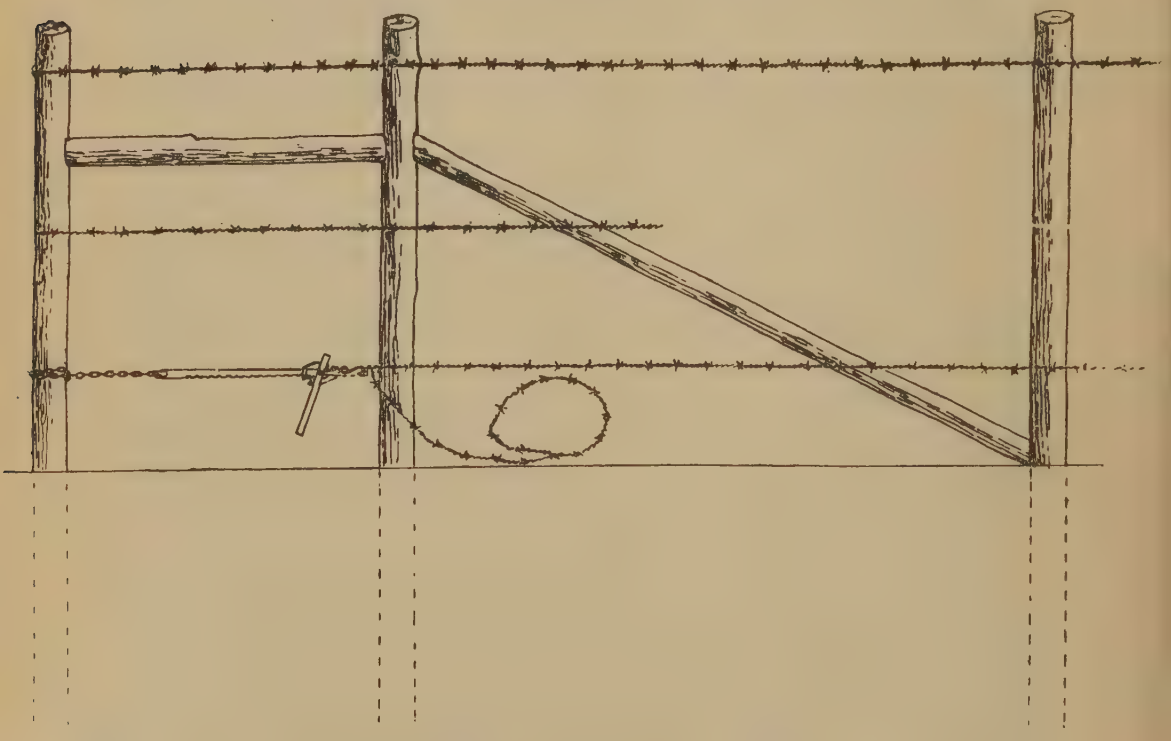


Fig. 6. Section of a barbed wire on wooden posts showing manner of bracing corner post to distribute the strain. Also barbed wire stretcher in use.

to stretch the wire, until sometimes the wire snaps. While one man holds on to the hammer another nails or ties the wire to the posts.

A better and more convenient tool than the hammer is a barbed wire stretcher as illustrated in figure 7. This tool does quicker and better work and

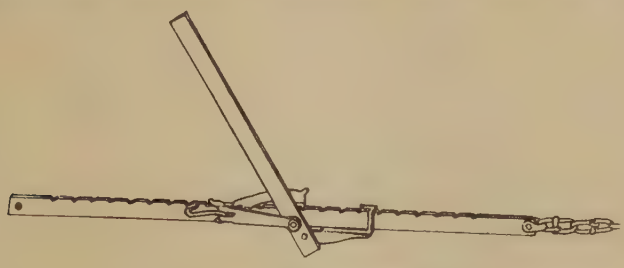


Fig. 7. A barbed wire stretcher.

saves the labor of the man that holds on to the hammer to keep the wire taut. The price of the stretcher is about ₱3.00.

For stretching woven wire the tool illustrated in figure 8 is convenient. After fastening the end of the woven wire to an end post the stretcher is fastened

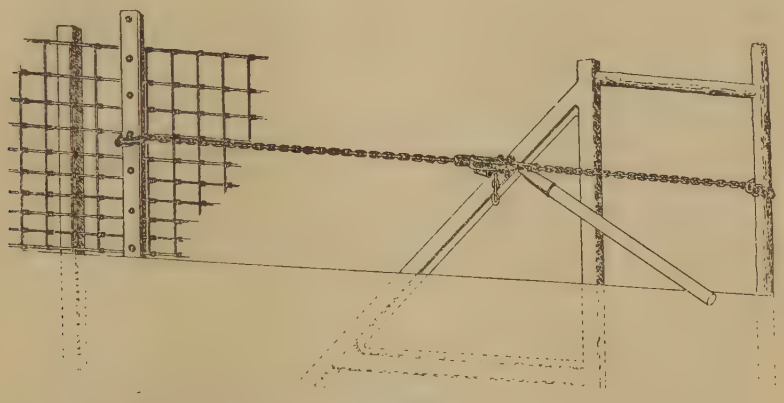


Fig. 8. Woven wire stretcher in use, showing temporary anchor post to prevent injury to concrete corner post.

to the other end and the wire is gradually stretched. The approximate price of this tool is ₱15.00.

PRICE OF WIRE FENCING

The price of wire fencing is so variable that quoted figures are of use only to indicate approximate cost. The figures given below are approximations of prices prevailing in the Manila market at the time of writing. For obvious reasons prices vary considerably among different dealers, also. This list will, however, serve as a basis in making estimates and as an indication of the relative cost of different kinds and dimensions of material and weave.

Barbed wire. Sold in rolls 80 rods, or 400 meters long. Price per roll, ₱7.00.

Woven wire. Rolls 20 rods, or 100 meters long, cross wires 6 inches apart.

47 inches, or 119 cm. high per roll	₱32.00
39 inches, or 99 cm. high per roll	₱28.00
32 inches, or 81 cm. high per roll	₱25.00
26 inches, or 66 cm. high per roll	₱21.00

This wire often may be obtained in small rolls, 50 meters (10 rods) in length and in large rolls, 200 meters (40 rods) in length; also with vertical stays 12 inches apart, cheaper but not as satisfactory as the kind with vertical stays 6 inches apart.

Poultry netting. Sold in rolls 150 feet, or 45 meters long.

2 inch mesh, 36 inches, 91 cm. high, per roll	₱ 7.00
2 inch mesh, 48 inches, 122 cm. high, per roll	₱ 9.00
½ inch mesh, 36 inches, 91 cm. high, per roll	₱ 9.00
½ inch mesh, 48 inches, 122 cm. high, per roll	₱14.00
1 inch mesh, 36 inches, 91 cm. high, per roll	₱14.00
1 inch mesh, 48 inches, 122 cm. high, per roll	₱22.00

SUMMARY

A table is here presented summarizing the relative cost of putting up different kinds of fences under local conditions. The figures in each case are for 100 meters in length.

Kind	*Price*	*Use*
Bamboo, *sala*, materials gathered	₱100.00	Yard
Bamboo, *sala*, materials purchased	172.00	Yard
Bamboo, *bila*, materials gathered	33.00	Yard
Wooden pole and post, materials gathered	26.50	Paddock, catching corral
Barbed wire, wooden posts gathered	12.05	Cattle, carabaos
Barbed wire, concrete posts made	59.38	Cattle, carabaos
Woven wire, 47 inches high, wooden posts gathered	38.80	Cattle, horses, swine
Woven wire, 47 inches high, concrete posts made	86.13	Cattle, horses, swine
Poultry wire, 6 feet high, rough wooden posts gathered	43.53	Chickens
Poultry wire, 6 feet high, commercial lumber posts	87.56	Chickens
Poultry wire, 6 feet high, commercial lumber set on concrete posts	112.10	Chickens

ANTHRACNOSE OF PEPPER[1], [2]

DEOGRACIAS B. MALABANAN

WITH TWO TEXT FIGURES

THE DISEASE

Geographical distribution and economic importance

According to Butler (1918) the anthracnose of pepper (*Capsicum annuum* L.) which was first described in the United States, occurs in Burma and probably also in India. Fulton (1908) reports the prevalence of the anthracnose of pepper in Louisiana in 1908. Higgins (1923) reports the occurrence of this disease in Georgia in 1923. Ocfemia (1924) reports anthracnose of pepper from the Philippines and states that in 1924, the disease caused 50 to 75 per cent of damage to fruits of pepper on the College Farm at Los Baños.

The anthracnose of pepper is usually of minor economic importance. Peppers planted during the dry season are subject to attacks of the disease at the beginning of the rainy season, perhaps on account of the sun-scalded effect on some of the fruits and leaves produced by the continuous hot weather. Plantings made during the wet season are usually less infected, if not entirely free from the disease.

Symptoms

The early stage of the anthracnose of pepper is characterized by small yellow or discolored spots on any part of the fruits (fig. 1, *a*) or leaves. The spots gradual-

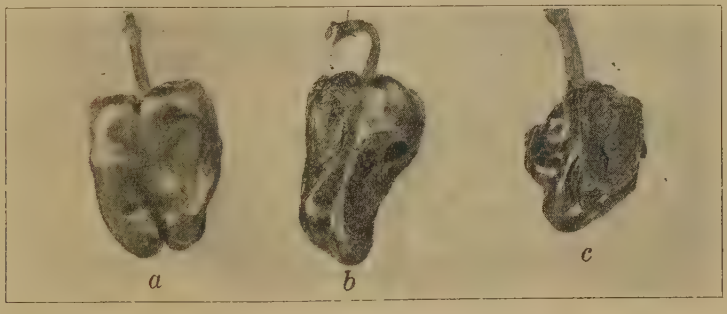


Fig. 1.

Fruits of sweet pepper; (*a*) showing small yellow or discolored lesion on any part of the fruit; (*b* and *c*) advanced stages of anthracnose infection showing black specks on the lesions arranged in concentric rings. Much reduced. (Photograph by the Photographic Division, Department of Agronomy, College of Agriculture.)

ly increase in size, become sunken, leaving somewhat circular lines of demarcations between the healthy and diseased portions (fig. 1, *b* and *c*).

[1] Thesis presented for graduation, 1925, with degree of Bachelor of Agriculture from the College of Agriculture No. 215; Experiment Station contribution No. 333. Prepared in the Department of Plant Pathology under the direction of Dr. G. O. Ocfemia.

[2] There are two fungi causing anthracnose of pepper in the Philippines. One is a *Gloeosporium* and the other a *Colletotrichum*. The present paper deals with the disease caused by a species of *Colletotrichum*.

As the spots grow old they change color from yellowish to grayish or brown. Black specks which are arranged in concentric rings are produced on the lesions (fig. 1, *b* and *c*). The black specks are due to the formation of setose acervuli. During the dry season the spots are dry and papery (fig. 1, *b*) and they may hasten the wilting and falling of the fruit. In rainy weather, the disease may cause rapid rotting and dropping of the fruits, leaves, and flowers.

CAUSAL ORGANISM

Morphology

Mycelium. The mycelium is septate, slightly constricted at the septa, branched, hyaline when young, and somewhat granular and brownish in color when old. The cells of the hyphæ are 3.66–14.64×3.66–7.32 μ.

Acervuli. The acervuli are somewhat circular in shape and of varying sizes, depending upon the condition of the weather during which they are formed. They are generally formed under the epidermis of the host tissue, but later become erumpent, and produce setæ which radiate from the stromatal axis (fig. 2, *a*). The diameter of the acervuli on the leaves measures from 56–100 μ and on the fruits from 50–250 μ. In pure cultures the acervuli are a little wider in diameter, owing perhaps to the more favorable and uniform conditions existing in the culture tubes.

Setæ. The setæ of the acervuli are 20 to 80, or even more. They are long, dark colored, almost black, septate, thick-walled, tapering, and lighter colored at the distal end (fig. 2, *a*). They are three to six times longer than the conidiophores. The number of the cells of the setæ varies from two to six. The setæ are 39.3–192.4×4.39–7.32 μ. No work to determine the function of the setæ was made during the present study.

Conidiophore. The conidiophores are hyaline, non-septate, filiform, of nearly the same width at the base as the conidia, tapering at the upper ends, and each bears an apical conidium. The length of the conidiophore is approximately one-third that of the setæ (fig. 2, *a*).

Conidia. The conidia are crescent-shaped, cylindrical, and tapering at both ends (fig. 2, *b*) and easily dislodged. The point of attachment cannot be distinguished on the conidium as soon as it becomes separated from the conidiophore. The conidia are unicellular, hyaline, and vary from 22–31.1×3.66–3.93 μ.

Conidia germination studies

From 10 to 15 day-old cultures of the fungus on oatmeal agar, a little of the slimy substance consisting of masses of conidia was scraped off and placed in a test tube of sterile water for dilution. By means of a platinum loop a few of these spores from the dilution were sown in hanging drops of distilled water, rain water, sterile tap water, melted and cooled plain water agar, and potato-dextrose agar in Van Tieghem cells. The conidia in distilled water germinated after two to three hours and those on water agar and potato-dextrose agar after four to five hours. In general, germination took place by the protrusion of a germ tube at the end, or any part on the conidia (fig. 2, *c*, *d*, and *e*). A germinating conidium becomes granular. The conidia in tap water produced germ tubes shorter than those on potato-dextrose agar and water agar, but longer than those in distilled water or rain water. Six hours after germination, a large spherical, or

ovoid, black, thick-walled body was produced at the distal end of the germ tube of each germinating conidium in water (fig. 2, *c*, *d*, and *e*). In distilled water, the short germ tubes themselves enlarged into spore-like structures. In water agar some of the structures appeared after 24 hours. On potato-dextrose agar none of these chlamydospore-like structures was formed until after three days. At this time they were mostly found at the edge of the drop of the medium. As

Fig. 2.

Camera lucida drawings of structures produced by the *Colletotrichum* on pepper in the Philippines showing *a*, portion of an acervulus with setae, conidiophores and conidia; *b*, conidia of the fungus from fruits of pepper; *c* and *d*, conidia germinating in tap water showing the production of dark-colored chlamydospore-like bodies on short germ tubes; and *e*, germinating conidia in hanging drops of distilled water showing sessile chlamydospore-like structures. All drawings are about 480×. In drops of potato dextrose agar the germ tubes are still longer than those produced in tap water.

to the nature of these chlamydospore-like structures, Hasselbring (1906) reports that Clinton, Alwood, Büsgen, Frank, Miss Southworth and others give their views. Some investigators are of the opinion that the formation of appressoria is due to the starvation of mycelium and to hard objects with which it comes in contact. This latter view is substantiated by results obtained in the present germination studies.

Cultural studies

Different media and sterilized plant tissues were used for growing the fungus in order to find out which of them are suited for the production of spores. In this study, at least five culture tubes of each medium and sterilized plant tissues were used. The media and sterilized plant tissues were tubed, plugged with cotton and autoclaved at 7 to 15 pounds' pressure for 20 to 30 minutes. The media were inoculated with conidia from pure cultures on potato-dextrose agar. Growth characters of the fungus were observed daily for one week, and weekly for one month after its transfer to the media.

The fungus grew readily upon a number of media. Growth on most media was characterized at first by a white mass of aërial hyphæ, then by pink, and finally by black, forming black specks or sclerotia-like bodies, bearing the setose acervuli. The time it took the fungus to sporulate and the number of spores and setæ produced depended upon the kind of media on which it was grown. Only one type of spores was produced during the study.

Potato-dextrose agar. On this medium the fungus began to grow in less than 24 hours. At first, growth was visible as cottony white, then pink, and finally black aërial hyphæ were produced. Growth was rapid, covering the entire surface of the medium in ten days. Seven days after the transfer was made, black specks began to appear, forming bands, arranged concentrically on the surface of the slanted medium. An abundance of setose acervuli was produced after a week. This medium was used for growing the fungus which was used in all inoculation work.

Water agar. The fungus began to grow in less than 24 hours. Very scanty aërial hyphæ were produced. Black bodies began to form after three days. Numerous black bodies which bear abundant setose acervuli were found. These were arranged either concentrically or scattered on the surface of the medium.

Nutrient agar. On this medium, growth was visible in less than 24 hours. Scanty aërial hyphæ were produced. Three days after transfer, black bodies, which were arranged concentrically on the surface of the medium, were produced.

Clinton's (1911) oatmeal agar. Although the fungus did not produce aërial hyphæ on this medium, an abundance of black bodies bearing conidia was produced three days after the transfer was made. A week later the fungus began to produce an abundance of a pinkish slimy substance in which myriads of conidia were embedded. For conidia production this medium was the best.

Eggplant decoction agar. This medium was prepared in the same way as the potato-dextrose agar, except that 200 grams of sliced eggplant was used instead of potato. Growth began in less than 24 hours. Only scanty mycelium was produced. At first, the mycelial mass was white, then pink, and finally it produced black bodies, arranged concentrically. Sporulation began four days after the transfer. The production of conidia was good. The slimy substance consisting of conidia appeared after 10 days.

Pepper-decoction agar. This was prepared in the same way as the egg-plant decoction agar, using 200 grams of sliced peppers. On this medium the fungus did not produce much aërial hyphæ, but acervuli were in abundance. The acervuli were visible after two to three days as black specks, arranged concentrically on the medium. Production of spores and setæ began after four days. A slimy substance consisting of conidia was produced two weeks after the transfer

of the fungus. This medium was good for the production of an abundance of mycelium, but not for the production of conidia. Growth was visible in less than 24 hours. It was first white and then brown. One week later, black bodies were formed, but no conidia were produced, even after four months. The fungus discolored the medium.

Glucose agar. On this medium, growth was visible before 24 hours. Growth was very thick, with production of an abundance of aërial hyphæ. After four days the fungus began to produce an abundance of black bodies without conidia. No fructification occurred on this medium until after four months.

Lima bean agar. This medium was prepared in the same way as potato-dextrose agar, except that 200 grams of ground Lima beans were used instead of peeled potato. This medium was one of the best. The fungus grew very luxuriantly, produced pinkish mycelium at first, which turned black after five days. The fungus produced an abundance of conidia in setose acervuli. After 10 days a thick slimy substance consisting of conidia was produced.

Sterilized pepper. The fungus grew very slowly, but after three days there was an abundance of setose acervuli produced. No aërial hyphæ were observed during its development.

Sterilized eggplant. The fungus began to grow after 24 hours. Good growth was obtained in both fruits and stems, although scanty aërial hyphæ were produced. There was a good production of setose acervuli after four days.

Sterilized tomato. After three days, growth was observed as scattered black bodies. No aërial hyphæ were produced and comparatively few black specks were formed.

Sterilized cowpea. On this tissue there was a good growth. The growth was shown by the production of an abundance of setose acervuli after three days, followed by production of slimy masses of conidia.

Sterilized long bean (*Vigna catjang*). The fungus growth was observed after two days, as small masses of mycelium. Numerous setose acervuli with slimy masses of conidia were produced also.

Sterilized papaya (*Carica papaya*). Blocks of green papaya fruit proved a good medium for the production of conidia of the fungus. Numerous setose acervuli with slimy masses of conidia were obtained.

Sterilized avocado (*Persea americana*). Avocado green fruit was cut into blocks and sterilized. This was one of the best plant tissues for the growth of the fungus. There was a quick production of setose acervuli. The production of fruiting bodies was similar to that on sterilized papaya.

Sterilized mango fruit. Blocks of green mango fruit (*Mangifera indica*) were used. This was a poor substratum for growing the fungus. The fungus growth was observed as flesh colored masses after 10 days. Upon examining the fungus under the microscope no fruiting bodies were noted and only mycelial knots and hyphal cells of irregular shapes were formed. Bits of the mycelium were transferred to potato-dextrose agar, oat agar, sterilized bean pods, and avocado blocks; and the fungus exhibited its usual cultural characters with the production of setose acervuli.

Sterilized potato cylinders. This was a good medium for the growth of the fungus. The growth was visible at first as white or pink masses of mycelium, which became black, with countless black specks of setose acervuli. The black

bodies covered the entire surface of the blocks and extended to the cotton at the bottom of the test tube.

Sterilized citrus stems and rind. Stems and rind of fruits of pummelo (*Citrus decumana*) were used. The growth was practically the same as that on sterilized pepper fruit and stem.

Sterilized upo (*Cucurbita pepo or Lagenaria leucantha*). Blocks and cylinders of white squash were used. The growth of the fungus was similar to that on eggplant fruit.

Sterilized patola (*Luffa acutangula*). Patola fruit in blocks was used and the growth of the fungus was similar to that on the white squash.

Sterilized green banana fruit (*Musa sapientum*). Sterilized banana was used for growing the fungus. Growth was very slow and was observed only as black specks with setose acervuli after one week.

Sterilized abaca (*Musa textilis*). Growth similar to that on banana was obtained.

Sterilized guanabano (*Anona muricata*). Growth was similar to that on banana.

Sterilized ates (*Anona squamosa*). Growth was similar to that on guanabano.

Sterilized santol. Blocks of santol fruits (*Sandoricum kætjape*) were used. Growth was very slow and was observed only after ten days as a blackening of the fruit, due to the presence of black setose acervuli. Very little growth was produced on the sterilized mango and santol fruits, probably because of their acidity.

Proof of pathogenicity

To determine whether or not the organism in pure culture is the cause of anthracnose of pepper, the writer made a series of inoculation experiments both in the laboratory and in the field. Only spores and mycelium from pure cultures were used for inoculation purposes. Liberal spores in water suspension were transferred to a sterile atomizer and sprayed upon the plants.

In the field, on sunny days, inoculations were made late in the afternoon, and on rainy and cloudy days at any time. Inoculations were made on leaves, stems, flowers, and fruits of peppers. Before inoculation, the parts of the pepper to be inoculated were sterilized with 1:1000 solution of mercuric chloride and then washed five times with sterile water. Inoculation was made on wounded or sun-scalded parts and on healthy parts. Immediately after the plants were inoculated they were bagged with glazed paper or covered with bell jars for certain periods of time to produce infection. In some cases plants were placed under bell jars for one or two days before they were inoculated in order to weaken them. After inoculation these plants were covered with bell jars again for some time to induce infection. Checks were carried at the same time.

The results in inoculation work show that the fungus failed to infect healthy plants and that it can infect pepper plants only after they have been injured or weakened by sun-scalding. However, once the fungus has gained entrance it can cause the disease rapidly, if favored by warm moist weather conditions. Sweet pepper varieties were found susceptible to attacks of anthracnose while hot pepper varieties were found very resistant to the disease. The writer con-

cludes that the fungus is a weak parasite, only. It is capable of attacking peppers only after they have been weakened by intense heat or injured mechanically.

Re-isolation of the fungus from plants inoculated in all series showed in every case a fungus that was the same as the original.

Infection of other plants

Inoculations were made through wounds and on healthy parts of fruits, stems, and leaves of eggplant, tomato, and on Lima bean. No results were obtained from inoculations on healthy parts of any of the plants. But inoculations through wounds were successful on fruits of tomato and eggplant. Diseased spots showed characteristic anthracnose infection more or less similar to the symptoms of the disease of pepper. Re-isolations from these lesions were made and the same fungus used in inoculation was obtained.

From this result, it is believed that the fungus in culture is capable of attacking eggplant and tomato, if these are weakened or injured.

Ability of the fungus to produce storage rots of vegetables

Fruits of tomato, eggplant, pepper, bean, and white squash were sterilized with 1 to 1000 mercuric chloride solution, then washed with sterile water and placed in jars with cotton batting moistened with sterile water. The fruits were pricked and then inoculated with liberal spores scraped from oatmeal agar culture. Checks were run with the duplicates of each kind of fruit. The degree of infection and the period of incubation varied. In tomato it took seven days before infection became visible; in pepper, seven days; in eggplant and squash, eight days; and in Lima bean, ten days.

From these results the writer believes that the fungus in cultures is capable of causing storage rots on some vegetables, especially if the fruits are kept in damp places or are handled carelessly so that they are bruised or injured mechanically.

Taxonomy

During the course of the present study it was not possible for the writer to refer to the original description of *Colletotrichum nigrum*, which was first described on pepper by Ellis and Halsted[3] from the United States. It is probable that the *Colletotrichum* causing anthracnose of pepper in the Philippines is identical with *C. nigrum* Ell. and Hals. A comparison of the morphological and physiological characters of the fungus occurring in the Philippines and in the United States is essential before a definite conclusion regarding the identity of the two fungi may be drawn.

Ellis and Everhart described *Glœosporium piperatum* as causing anthracnose of pepper. It has been reported that certain forms of both *Glœosporium* and *Colletotrichum* produce ascosporic stages which are species of the genus *Glomerella* (Shear, and Wood, 1913)[4].

[3] *Cited by* Stevens (1913.)

[4] Mr. Julian A. Agati of the Department of Plant Pathology has obtained perithecial bodies on dead peppers infected with *Glœosporium*. So far, however, he has not found mature asci in these ascocarps. It is not known whether the Philippine *Glœosporium* on pepper is identical with *G. piperatum* Ellis and Everhart or not. Neither is it known if the perfect stage is identical with *Glomerella piperata* (Ell. and Evht.) S. and S.

In the United States *Glomerella piperata* (Ell. and Evht.) S. and S.[5] has been reported on pepper. Whether or not this fungus is the perfect stage of *Glœosporium piperatum* cannot be stated with certainty because of lack of literature. In the Philippines no other stage of the fungus except the *Colletotrichum* or imperfect stage was noted during the course of this work.

DEVELOPMENT OF THE ANTHRACNOSE OF PEPPER IN 1924 AND 1925

The disease occurred in the College truck garden from April to December, 1924. Almost all the pepper plants set out in March, 1924, showed symptoms of the disease until December of the same year. On September, 1924, a second crop was planted between the rows of old plants. The second crop was infected by the disease during the months of November and December, 1924, and also during the months of January and February, 1925. Fruits of the first crop were more severely attacked than those of the second crop.

WEATHER CONDITIONS IN RELATION TO THE DEVELOPMENT OF THE ANTHRACNOSE OF PEPPER IN 1924

During the rainy days in September and November, 1924, very little infection was observed in the garden. The disease was common on days of slight rainfall followed by hot days or prolonged hot days followed by showers. The weather during 1924 was warm and moist and the disease was very common. This seems to show that the fungus develops very well under warm moist conditions but not on wet and cool days.

PRODUCTION OF SPORES AND SPORE DISSEMINATION

The production of spores occurs on old infections on pepper on warm and moist days. Sporulation continues as the lesions develop. Only one type of spores was produced in natural and artificial infections both in the field and in the laboratory. Only one type of spores was produced in pure cultures on different media and substrata, although the time of sporulation varied a great deal.

The conidia of the pepper *Colletotrichum* are moist and are held together in a slimy matrix. For this reason they cannot be dislodged by wind. The conidia are easily dislodged by water by first diluting the gelatinous matrix. In a diluted condition the conidia may be spattered by rain.

Flies and other insects were found responsible for disseminating the spores from one fruit to another. The German cockroach, or Croton bug (*Ectobia germanica*)[6] was found feeding on fruits of sweet pepper. After a week, fruits with wounds made by this insect became infected by anthracnose. Experiments to determine whether or not the German cockroach is responsible for disseminating the spores showed that the insects made wounds on the fruits and five to seven days later, some of the fruits showed the disease on the wounded parts.

[5] *Cited by* Stevens (1913.)

[6] The writer wishes to thank Dr. L. B. Uichanco, Acting Head of the Department of Entomology of the College of Agriculture, for identifying this insect.

METHOD OF INFECTION AND PERIOD OF INCUBATION

It was found that the fungus could not infect uninjured plants as readily as wounded ones. The fungus produces infection more readily on sun-scalded or wounded fruits, leaves, and stems. This was proven by repeated artificial inoculations and by close observations in the gardens.

The incubation period in the field and in the laboratory was four to five days. The period of incubation may vary greatly according to the kind of inoculum used. If conidia alone were used it took the fungus a longer time to produce the disease. If conidia and vegetative mycelium were used infection took place more readily.

LONGEVITY OF SPORES

No reliable data regarding the longevity of spores on diseased pepper placed under the sun and rain can be given because the specimens placed out of doors rotted and the spores disappeared in less than a month.

CONTROL MEASURES

From observations in the garden of the College of Agriculture and in small plots around the College it was noted:

1. That during the months of April and May, 1924, infected plants became the sources of infection. From this it would seem that late planting is not advisable. Thick plantings have poor ventilation, a condition which induces good growth of the fungus. Proper distancing seems advisable, especially in the case of the Bolivian pepper.

2. Weakened fruits and leaves and plants, sickly in appearance, are readily infected. Once infected they are sources of inoculum. It is worth while to remove all diseased portions and all sickly plants from the field and burn them to eliminate sources of inoculum for infection.

3. Observations showed that a crop of pepper planted in infected fields was infected readily. This showed that continuous cropping of pepper in the same field is not advisable. Crop rotation would help in preventing the spread of the disease, but this phase of control should be studied thoroughly before recommendations for the practice can be made.

4. The writer noted that only hot pepper varieties were resistant to the attack of anthracnose in the College. The hot varieties, however, have no such place in the diet as the fleshy Ruby King peppers. The hot peppers are of importance because of the oil which is extracted from them for medicinal purposes.

SUMMARY

1. The anthracnose of pepper (*Capsicum annuum* L.) is common in the College as well as in gardens around the College Farm, at Los Baños, Philippines.

2. The disease occurs in Burma, India, in Louisiana, Georgia, and many other states of the United States, and perhaps elsewhere.

3. The anthracnose of pepper is usually only of minor economic importance. Late plantings, or peppers planted during the dry season are usually subject to attacks of the disease at the beginning of the rainy season.

4. The symptom of the anthracnose of pepper is characterized at first by small yellow spots on fruits and leaves. These lesions usually increase in size,

become gray and sunken, leaving somewhat circular lines of demarcation between the healthy and diseased portions. In advanced stages of the disease, black specks which are arranged in concentric rings are produced on the lesions. These black bodies are fruiting structures of the causal fungus.

5. During the course of the present study it was not possible for the writer to refer to the original description of *Colletotrichum nigrum* which was first described on pepper by Ellis and Halsted from the United States. However, it is believed that the *Colletotrichum* causing anthracnose of pepper in the Philippines is identical with *C. nigrum* Ell. and Hals.

6. The black specks are due to the presence of long black hair-like structures, the setæ.

7. Fresh conidia germinate readily in water and on agars. Germination of conidia takes place after two to three hours in water and four to five hours on agar. In general, germination takes place by the protrusion of a germ tube at the end or any part on the conidium. There is always an appressorium produced at the end of each germ tube in water. In a condition where there is nutrient and where the germ tubes do not come in contact with hard objects no appressorium is produced.

8. The fungus grows readily upon a number of common media and sterilized plant tissues. Growth on most media is characterized at first by a white mass of aërial hyphæ, then by pink, and finally black specks, or sclerotia-like bodies, bearing the setose acervuli may be seen. The time it takes the fungus to sporulate and the number of spores and setæ produced depend upon the kind of media on which it is grown. The media best adapted for the production of abundant spores and setæ are: Potato-dextrose agar, oatmeal agar, Lima bean agar, eggplant decoction agar, pepper decoction agar, sterilized cowpea, long bean, papaya, avocado, potato cylinder, white squash, patola, eggplant cylinder, and pepper slices.

9. The fungus is a weak parasite capable of attacking peppers only after these have been weakened or injured mechanically. However, once the fungus has gained entrance it invades the tissues of the host rapidly, especially if favored by warm moist weather. Sweet pepper varieties are subject to its attack while hot varieties are not.

10. In cross-inoculations the fungus was found capable of attacking eggplant and tomato, if these were weakened or injured. The fungus is capable of causing storage rots of some vegetables if fruits are kept in damp places or are handled carelessly.

11. The spread of the fungus in gardens is caused by meteoric water, certain insects, and perhaps by other means which are not known.

12. As the disease is of minor economic importance no special control measures seem necessary. Observations showed that the disease may be controlled by proper methods of planting, sanitation, and seed selection.

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EXCHANGE NOTES

For several years past the possibilities of alcohol as a fuel for internal combustion engines have been under consideration. It is recognized that alcohol is, so far, the only true artificial fuel—one which can be manufactured without having recourse to raw materials which are themselves natural fuels. It is admitted that supplies of petroleum and of coal and like minerals, which today furnish all the liquid fuels suitable for use in internal combustion engines, are not inexhaustible; that some day it seems certain fuel will have to be manufactured from other raw material. Alcohol, in the light of today's knowledge, is the only liquid which we actually know how to produce independently in quantities which are in any way capable of contributing materially to requirements.

That alcohol, either alone, or better in admixture with other combustible liquids, is a practical fuel, with certain definite advantages, has been proved not only by experimental work but in the greater test of actual commercial use. . . .

The most promising source of cheap raw materials lies in the prolific vegetation of tropical countries, which would furnish practically inexhaustible quantities of alcohol. Here in Nature's great laboratories the heat energy of the sun could be transformed into potential fuel in a few weeks or months. But the problem is: Are the resources of man's laboratories equal to the release of this fuel in a form suitable for use in internal combustion engines, in other words, as alcohol? The process must be simple and economical and no such process has so far been devised.

—*Journal of the Royal Society of Arts* (London).

Very few small poultry keepers realize the value of charcoal in cleansing the fowls' system and keeping away disease. Many birds which appear out of condition owing to digestive troubles or other complaints can be brightened up and restored to health by having free access to a hopper of prepared charcoal, but as with grit, it should not be mixed with the food, forcing the birds to eat more than they require. . . .

If the birds are provided with a dust bath of ashes it will be noticed that they will readily pick out small particles of charcoal or wood ash while dusting themselves.

—*Journal of the Board of Agriculture* (British Guiana). Reprinted from *South African Poultry Magazine and Small-holder.*

Cheese is a food second to none and cheaper than any commodity (or group of them) of similar food value. Its extremely high food value, both as regards protein and total energy, entitles it to a much more important place in the diet than it has commonly been given in this country. Travelers going into places where the food supply is uncertain, and desiring to carry a food providing a large amount of energy with as little bulk as possible, have long recognized its value. . . .

As a substitute for meat, cheddar cheese holds first rank both in regard to food value and relative cost. Instead of being used solely as an appetiser or condiment, cheese is worthy of and should be given a substantial place in the diet.

No mention has been made of the indispensable dietary constituents known as vitamines. Fat-soluble A and water-soluble B are both present in cheese. Butter-fat contains fat-soluble A in abundance. Vegetable oils do not furnish this vitamine, neither are the body fats of animals, such as lard or beef fat, important sources of it.

—*Agricultural Gazette* (New South Wales).

The citrus industry of California is universally acknowledged to be the most soundly organized agricultural enterprise in the world. . . .

The California Fruit-growers' Exchange is composed of three units, built up from the 12,500 citrus producers who comprise the grower-membership. The growers formed local associations of which there are now about 210; these in turn federated to form 22 district exchanges, and the latter formed the main body, the California Fruit-growers' Exchange. . . .

The California Fruit-growers' Exchange was created to lessen the cost of marketing by forming agencies to act for each member; to ensure the collection of sales accounts; to facilitate the collection of damage claims; to encourage the improvement of the product and the package; to increase the consumption of citrus fruits by developing new markets, and to aid in supplying all the people with good fruit at a reasonable price.

—*Journal of the Department of Agriculture* (Union of South Africa).

The cashewnut trees are seen in abundance throughout the district. . . . The immature nuts are opened vertically and the kernel on separation used for home consumption either for raw eating or for culinary purposes and in places with market offered for sale; while the dried nuts are roasted in open fire and the kernels used for eating as such locally and never as a commercial commodity. The method in vogue here of roasting dried nuts consists in spreading about 20 to 30 nuts on soil and covering these with a thin layer of grass or dried leaves and finally setting fire to the whole mass. It is the oil contained in the husks that first gets heated, exudes and begins to burn violently and then when the oil is exhausted, it is the woody portion of the husk that begins to burn. It is just at this stage when the woody portion begins to burn, that the nuts must be removed from the fire so that they may not be overburnt to affect the inside kernel.

—*The Poona Agricultural College Magazine* (India).

COLLEGE AND ALUMNI NOTES

In *The Journal of the Board of Agriculture* (British Guiana) for July, 1925, appear twenty-four pages of extracts from "A Guide for Beginners in Chicken Raising" by F. M. Fronda of the Poultry Division of this College. This publication by Doctor Fronda is Circular No. 3.

In the October number of *Sugar News* we note articles by Dr. Manuel L. Roxas, Dr. Robert L. Pendleton, and Prof. C. P. Johnson, all of the faculty of this College; also by Mr. Atanacio Carandang, B.S. '22, and Mr. Julio M. Jamais, B. Agr. '20, two of our graduates.

The fifteenth scientific meeting of the Los Baños Biological Club was held in the Auditorium in the evening of October 29. The following papers were read and discussed: "Rhizoctonia disease of rice," by Mr. M. A. Palo. "The intensity and distribution of infectious diseases of animals in the Philippines," by Dr. A. K. Gomez. "Weighing large farm animals on a portable scale," by Dr. B. M. Gonzalez.

Dr. Manuel L. Roxas, Head of the Department of Agricultural Chemistry, has been granted leave by the Board of Regents and is now working for the Philippine Sugar Association as Director of the Luzon Cane Field Testing Department. Dr. F. O. Santos has been appointed Acting Head of the Department.

Miss Sybil Vedder was recently appointed as instructor in English. Miss Vedder was graduated from Randolph-Macon college with degree of A. B. Later, she carried some post-graduate work in English in Johns Hopkins University.

Dr. Vicente G. Lava Ph. D., in physical chemistry from Columbia University, has been appointed associate professor of agricultural chemistry, effective October 16. Doctor Lava was for some time physical chemist for the Bureau of Science.

Mrs. Alma H. Burton, assistant professor in English, resigned at close of first semester. Mrs. Burton sailed for Europe in latter part of October.

Prof. Felipe T. Adriano of the Department of Agricultural Chemistry is now taking post-graduate work in analytical chemistry at Cornell University. Mrs. Adriano is attending the Conservatory of Music at the same institution.

Professor Alincastre has been granted leave for the rest of the year and is working as chemist for the Isabela Sugar Planters' Association.

Mr. A. B. Nourse, instructor in English, resigned at close of first semester.

Miss Mamerta Manahan, graduate student in chemistry, was elected president of the Student Body for the second semester and has just been appointed graduate student assistant in the Department of Chemistry.

Mr. Getulio Guanzon, graduate assistant in Sugar Technology, was granted Certificate in Sugar Technology at University Council Meeting of November 7. At this same meeting the following *ad interim* graduates were granted degrees: Juan Pronto and Leopoldo Salazar, B.S.A. (Supplementary Curriculum.) Federico Goseco, Cipriano Barbon and Mateo Jimenez, B. Agr.

List of new books and other publications added to the Library of the College of Agriculture, October 1-31, 1925.

The American fertilizer handbook. 1925.

Anderson, W. B.
Physics for technical students in colleges and universities. 2nd ed. 1925.

Association of Official Agricultural Chemists.
Official and tentative methods of analysis. 2nd rev. ed. 1925.

Birchmore, W. H.
The interpretation of gas analysis. 1906.

Bocobo, J.
The radiant symbol. 1925.

Bower, F. O.
Botany of the living plant. 1923.

Chapman, Sir S.
Outlines of political economy. 2nd ed. 1925.

Chase, A.
First book of grasses. 1922.

Carleton, M. A.
The small grains. 1924.

Chekhov, A.
Love and other stories. 1923.

Chisholm, G. G.
Handbook of commercial geography. New ed. 1925.

Dana, J. C.
A library primer. 1920.

Darling, E. R.
Inorganic chemical synonyms and other useful chemical data. 2nd ed. 1922.

Doubleday, A. W.
Photomicrographs of crystallizable chemical salts. 1916.

The Encyclopædea Britanica. Vol. XXX to XXXII. 1922.

Elles, G. L.
The study of geological maps. 1921.

Fabre, J. H.
This earth of ours. 1923.

Faculty of the Library school, University of Wisconsin.
An apprentice course for small libraries. 1917.

Fay and Eaton
Instructions in the use of books and libraries. 1924.

Fenton, H. J. H.
Physical chemistry for schools. 1920.

Firth, J. B.
Practical physical chemistry. 1915.

Guthrie, E. S.
The book of butter. 1923.

Harvey-Gibson, R. J.
Outlines of the history of botany. 1919.

Haskell, S. B.
Farm fertility. 1923.

Hearn, L.
Kotto; being Japanese curios, with sundry cobwebs. 1923.

Helser, M. D.
Farm meats. 1923.

Hitchler, T.
Cataloging for small libraries. Rev. ed. 1915.

King, F. H.
Farmers of forty centuries or permanent agriculture in China, Korea, and Japan. 1911.

Ling, G. H., et al.
Elements of projective geometry. 1922.

Lloyd, S. L.
Mining and manufacture of fertilizing materials and their relation to soils. 1918.

Long, H. C.
Plants poisonous to live stock. 2nd rev. ed. 1924.

Low, Thos. A.
The Canada year book. 1924.

Miller, W. J.
An introduction to physical geology with special reference to North America. 2nd printing. 1925.

Murray, B. L.
Standards and tests for reagent chemicals. 1920.

Neuman, J. J.
The Polyporaceæ of Wisconsin. 1914.

Noyes, A. A.
A course of instruction in the qualitative chemical analysis of inorganic substances. 1924.

Noyes, A. A., et al.
An advanced course of instruction in chemical principles. 1923.

Onslow, M. W.
Practical plant biochemistry. 1923.

Percival, J.
Agricultural botany. 1921.

Powers, E., et al.
Practical exercises in rapid calculation. 1917.

Rigg, G. B.
The pharmacist's botany. 1924.

Rose, M. S.
Feeding the family. Rev. ed. 1925.

Rose, T. K.
The precious metals comprising old, silver, and platinum. 1909.

Sligman, E. R. A.
Principles of economics with special reference to American conditions. 10th rev. ed. 1923.

Smith, D. E.
History of mathematics.

Smith, C. M., et al.
A text book of general botany. 1924.

Smith, G. M.
Phytoplankton of the inland lakes of Wisconsin. 1920.

Smith, W. W.
Pork production. 1923.

Stearns, L. E.
Essentials in library administration. 1922.

Talbot, H. P.
An introductory course of quantitative chemical analysis with explanatory notes. 6th ed. Completely rewritten. 1924.

Thom, C., et al.
The book of cheese. 1921.

Tractor and implement blue book. 1925.

Weir, W. W.
Productive soils. 2nd rev. ed. 1923.

Wyer, J. I.
U. S. Government documents. (Federal, State, and City.) 1922.